Design Engineering

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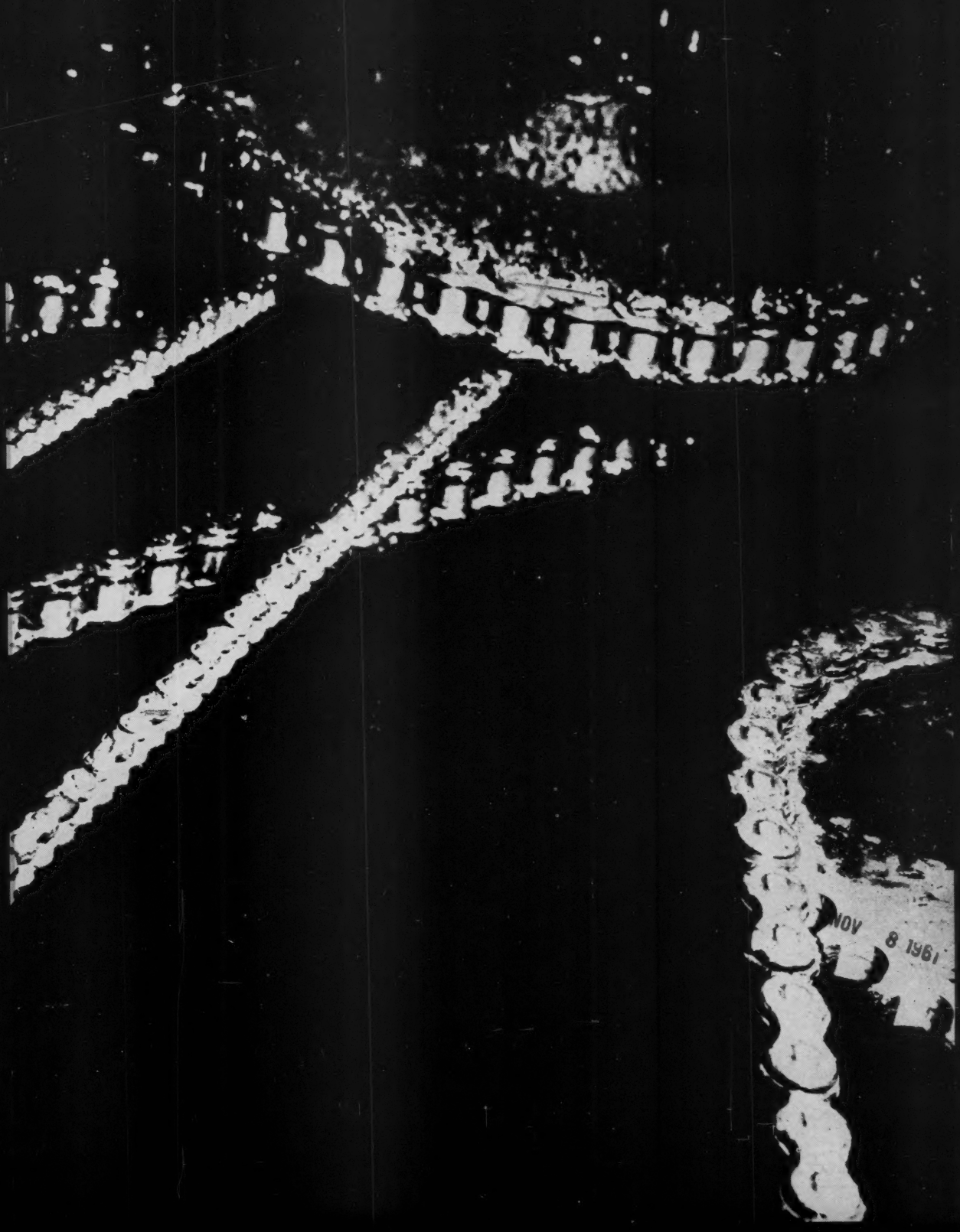

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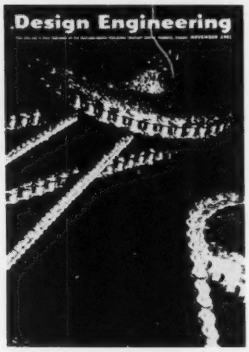

This month's cover

Mechanical power transmission is the major theme of this month's issue . . . and what could be more typical than chain drives. Photographer Ron Vickers, ARPS, put this one together for us from shots of an actual installation at one of the plants of the Goodyear Tire & Rubber Company of Canada Limited.

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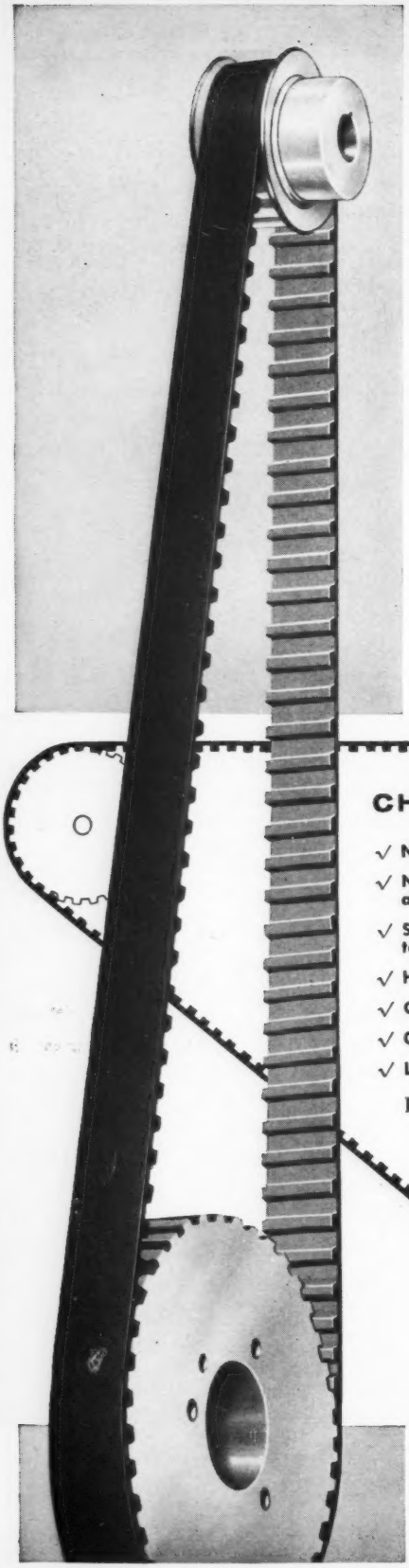

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Trade Minister Hees calls halt to copying of foreign design

Canada must stop merely imitating successful foreign designs. This was the main plea of the Minister for Trade and Commerce George Hees in addressing the first meeting of the revamped National Design Council.

Mr. Hees said there was evidence all around us of Canada's dependence on the work of others. He cited Canadian products described as being "Danish inspired" or "Scandinavian style".

"I do not wish to deprecate the splendid models that these and other industrial countries offer, but our designers, if given the opportunity, are surely capable of equally bold and imaginative practical forms," he said. "Many outstandingly fine Canadian products prove that we have design skill in this country. It is our task and yours (the Council) to persuade the business community to give more scope to designers so that distinctively Canadian forms and styles may be brought into all markets."

The minister said it was not good enough to call in the designer at the end of a product's development to deal with the shape, finish and decoration. It should be realized that design began at the initial stage of development.

Mr. Hees said he'd been told some manufacturers shied away from design because they were concerned it would add substantially to the cost. But he explained that design which failed to take account of the possibilities and limitations of the material and the availability of machines and tools was surely not good design, or at least not realistic design.

"I regard design as being of equal importance as quality, servicing and competitive prices," he said. "It is one of the most effective means of upgrading the value of the products of Canada's economy."

Canada boosts share of U. S. defense orders

U. S. defense business placed in Canada for the first eight months of 1961 jumped by about 45% compared with the same period last year.

Defense Production Minister Raymond O'Hurley told the House of Commons during his estimates debate that production sharing contracts totalled $79.9 million at the end of August, compared with $55 million last year.

This year's 8-month total comprises $43 million in prime contracts and $36.8 million in subcontracts.

Mr. O'Hurley said $5.5 million had been set aside by his department for the current fiscal year to assist industry with developmental work and maintain technological developments. This figure was $.5 million up on the year 1960-61.

Examples of major projects cited under this program: the V/STOL aircraft by Avro, Canadair and de Havilland; turbine engines by Orenda and Pratt & Whitney; airborne electronic equipment by Marconi and Computing Devices of Canada; radar items by Long Sault Woodcraft and Fleet Manufacturing; communications equipment by Radio Engineering Products; and rocket vehicles by Bristol and Canadair.

Mr. O'Hurley gave this list of prime contracts: Aircraft and spares for de Havilland Caribou aircraft, $7.7 million; engine spares, repair and overhaul to Pratt & Whitney, $11.7 million; sonobuoys to Sparton, $1.1 million; cartridges to Canadian Arsenals, $3.9 million; field telephones to Radio Engineering Products, $1.6 million; engine development to Orenda, $913,000; plotting tables to Marsland Engineering, $2.6 million. In addition Canadian Marconi had received a firm order for airborne doppler navigation radar worth $370,000 and negotiations were under way to increase this to $1.7 million.

"There are good prospects for additional large orders," he added.

Productivity Council studies rationalization

The National Productivity Council is studying one of Canada's most controversial economic issues: rationalization. This means re-arranging the nation's production facilities to get economic volume output.

Recent remarks by President George De Young make it clear the council will be more than an information centre for combines problems. It should have suggestions for industry and government.

The honorable member is never wrong

The official Hansard record contains at least one amusing quote from the session just past.

The remarks were made by a backbencher who left the Commons chamber for five minutes. On returning he found that a bill dealing with Manitoba school lands, and in which he was interested, had been debated and approved in an unusual three and a half minutes.

His quote: "Mr. Speaker. I had criticized this agreement without knowing what the agreement was, and I happened to be right."

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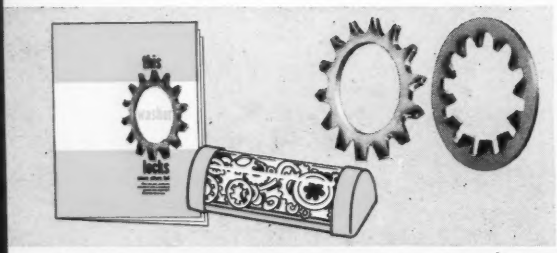

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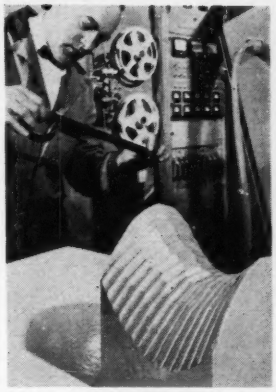
Reports — A world roundup of engineering and design interest

Computer controls machine tools from simple written instructions



A new computer language has been announced to broaden the use of numerically controlled machine tools for automatic production of complex parts. In fact it's the first program that allows the user to describe the surfaces of a three-dimensional shape to be milled, rather than show each path the machine must follow to machine the part. The computer automatically generates the tool paths from a simple description in English-like terms commonly used in the shop.

Production of a complex helicopter gearbox was the first practical work ever completed. It was machined on a tape-controlled continuous-path milling machine. From the blueprint, only 180 one-line statements in the special language were written to describe the part. A solid-state computer then used the information to generate 8,000 tool path instructions which spelled out every tool motion required by the machine. These instructions were converted to perforated tape and the job completed in one-fourth the machining time required with conventional methods. Saving in lead time was even greater. From blueprint to production by conventional methods would have taken three months. The new way took two weeks.

An example of the computer language for defining a bowl-shaped surface might be: BOWL= SPHERE, INSIDE/CENTER (0,0,0) RADIUS (1.75). The computers' vocabulary comprises 110 words of familiar shop terminology and there is a great deal of built-in latitude for assembling sentences and paragraphs.

But obeying instructions is not enough. The program is designed to enable the computer to turn out printed reports of errors which may occur in the part description. And a printed list of coordinates for each tool position is prepared to enable the manufacturer to visualize the path of the tool before production. *Source: International Business Machines.*

Process directly produces sheet steel from iron ore

Large-scale pilot plant production of plain carbon steel sheet is now possible by directly processing iron ore without melting. This is the latest stage reported in the experimental work of a self-governing Canadian non-profit R&D organization.

This is how it works. A porous bed of finely ground, high purity iron ore (99% or more iron oxide) is laid on a permeable support which is the liner of a specially designed metal or ceramic pallet. A number of pallets joined end-to-end in a continuous bed of ore is passed through a furnace like a long tunnel brick-kiln.

The ore passes through three zones. First it is preheated and partially reduced. In the central zone, a hot reducing gas rich in hydrogen and carbon monoxide is forced through it at 2100 F achieving complete reduction to metallic iron. Finally the porous low-density steel slab is sintered to increase density and strength. Carbon content is regulated by carefully controlling gas composition.

The sintered slab, still at 2100 F, is stripped from the pallet liner and passed through a rolling mill near the discharge end of the furnace. In a single pass the slab is formed into solid steel sheet, about one-tenth the thickness of the sintered slab. A final cooling in a reducing atmosphere produces the end product — clean, bright, sheet steel of full density. *Source: Ontario Research Foundation.*

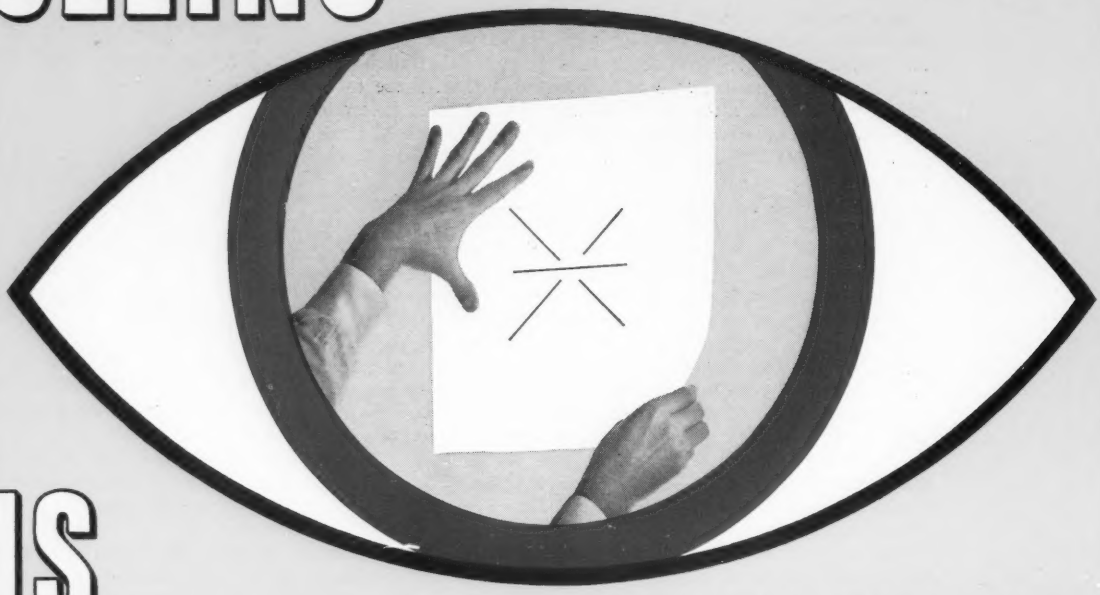
New finding may result in improved microwave devices

A significant advance has been revealed in the understanding of yttrium iron garnet (YIG), a material that offers substantial improvements over ferrites in many electronics applications. YIG is similar to the ferrites in that it's ferrimagnetic, but its different crystal structure makes it a much better electrical insulator. Both also transmit microwave radiation with very little loss.

Pioneering work on the resonance properties of YIG revealed that very narrow linewidths were obtainable. By polishing the crystals to an extremely smooth finish and developing methods for removal of impurities the linewidth was successfully lowered to .14 oe. This agreed closely with a recently developed theory, except at very low temperatures, and it's believed to be the intrinsic linewidth of perfect YIG.

The figure of .14 oe is many times narrower than that reported for the best ferrites (usually around 5.00 oe) . . . a big feature in the design of such things as turnable filters and power limiters for microwave systems. *Source: Bell Telephone Laboratories.*

SEEING



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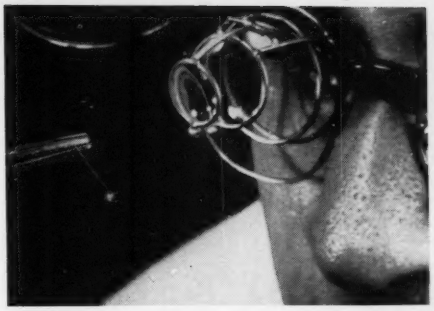
Greater miniaturization and speed for electronic devices



Revolutionary advances in space exploration, medicine, electronics, industrial processes and atomic research are foreseen as the result of two new developments. Both are based on the discovery that tiny crystals can be used to make "ultra-miniaturized" devices capable of performing tasks and gathering knowledge beyond scientists' attainment with today's instruments.

One development is a radiation detector containing a crystal the size of a pinhead that measures nuclear particles 1,000 times faster than any counting device now in use. Known as a solid state ionization chamber, it is so small that it can be packaged in the tip of a hypodermic needle and so accurate that it can analyze particle energy to less than one per cent error. In treatment of cancer, the tiny detector can be inserted in the human body to determine instantly the radiation dose necessary for destruction of malignant tissue. It also can simplify and improve industrial processes that utilize radiation to control the quality of products. Clusters of hundreds or thousands of the minute detectors, enclosed in space vehicles, may be used to measure cosmic rays.

The other development, which also utilizes crystals of silicon or possibly germanium, opens the way for construction of a wide variety of electronic devices that will be more reliable, of simpler construction, and up to 1,000 times smaller. The tiny crystal should make possible radio receivers as small as a pea and phonograph amplifiers less than one-half inch in diameter. Instruments with "crystal hearts" may simplify the count-down that precedes the launching of rockets and missiles, may improve the guidance of space vehicles, measure light intensity and radiation levels in space and simplify communication systems. *Source: U.S. Information Service.*

Canadian designed radio circuit with fewer transistors

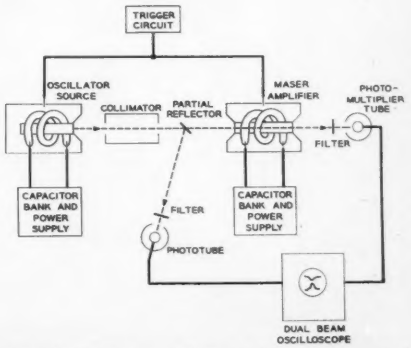
A Canadian manufacturer of electronic components has developed a circuit design for a cordless mantel radio that needs only five transistors to do a job normally requiring seven. The circuit and a detailed 32-page analysis have been distributed free to Canadian radio manufacturers. The pitch is that it will help Canadians cut costs and compete favorably with foreign manufacturers, notably the Japanese.

According to the developer, radios made using this circuit should retail for $30 or less. They would run up to six months of normal daily use on four standard size flashlight cells costing 18c to 25c each. Secret of the circuit is claimed to be the use of new alloy-diffused transistors with very high gain. *Source: Philips Electronic Industries Ltd.*

Optical masers may be useful as light amplifiers

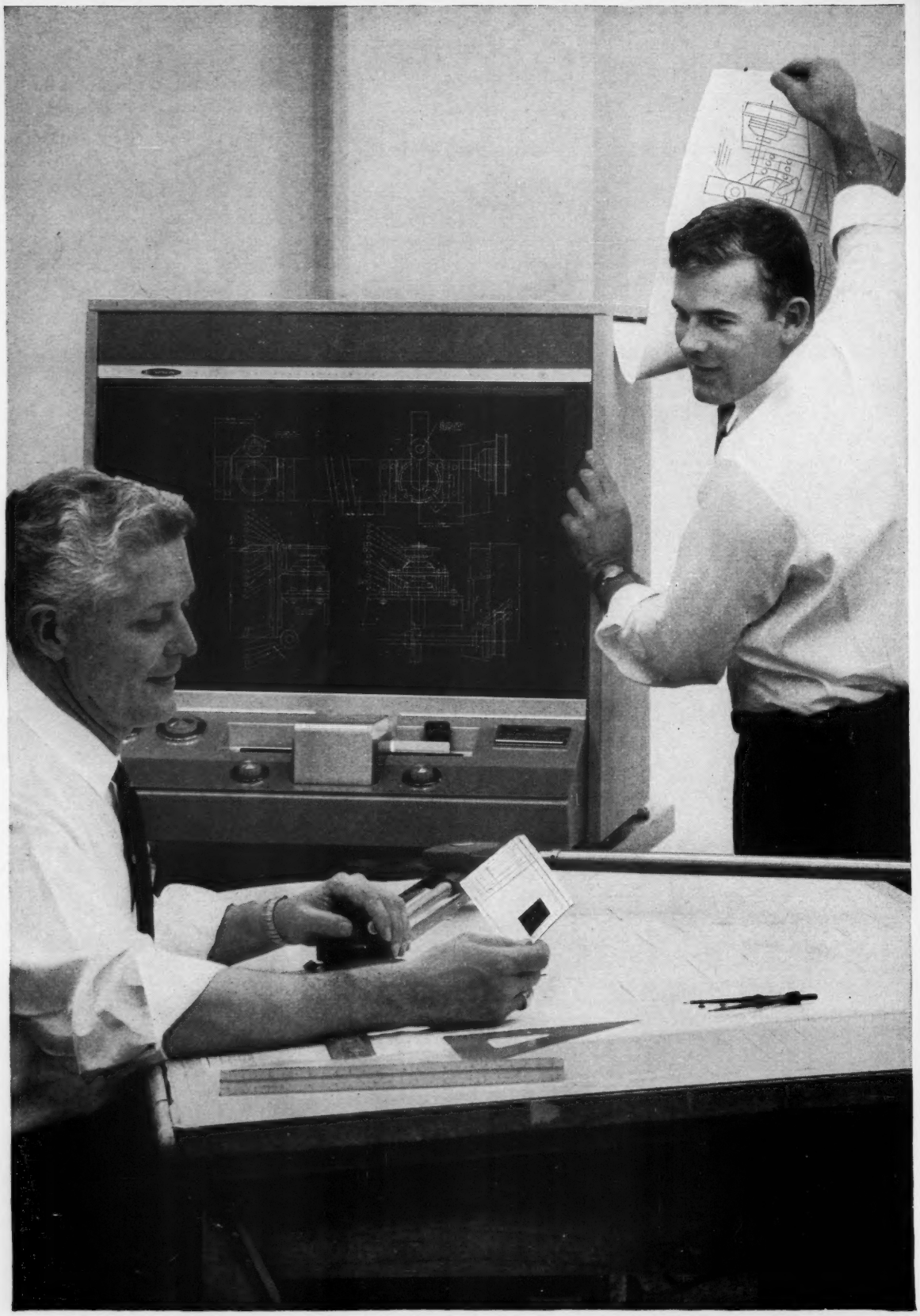
The first results have been published of experiments in which a pulsed ruby optical maser has been successfully operated as a light amplifier. While it has been known that maser oscillators amplify light enough to make up for losses at the end mirrors, it has been difficult to directly measure such large amplification.

The main problem has been distinguishing coherent maser light from the natural fluorescent light of the maser. But this was solved using a ruby maser oscillator to generate coherent light which was so bright that the fluorescence from the amplifier ruby was comparatively small. The amplifier ruby was similar to the light-source ruby except that the ends of the ruby rod were not silvered.



When the two rubies were fired simultaneously, the output from the amplifying ruby was measured by a photomultiplier tube. Both the signal going into the amplifier and the signal coming out were displayed on a dual-beam oscilloscope. Gain was measured by comparing output-to-input ratio (using the amplifier) to that obtained when the amplifier was removed from the beam. Gain depends on the temperature of the amplifying master and the pumping power and a net gain of factor of two was observed at minus 40C.

It is believed that a more precise experimental setup and greater temperature control may result in even larger amplifiers. Nevertheless maser amplifiers are as potentially important to communications as maser oscillators. *Source: Bell Telephone Laboratories.*



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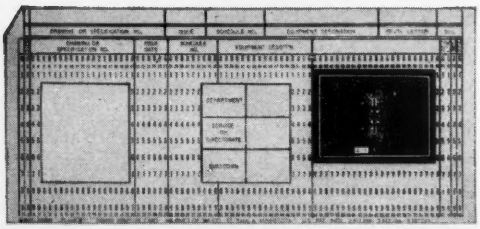

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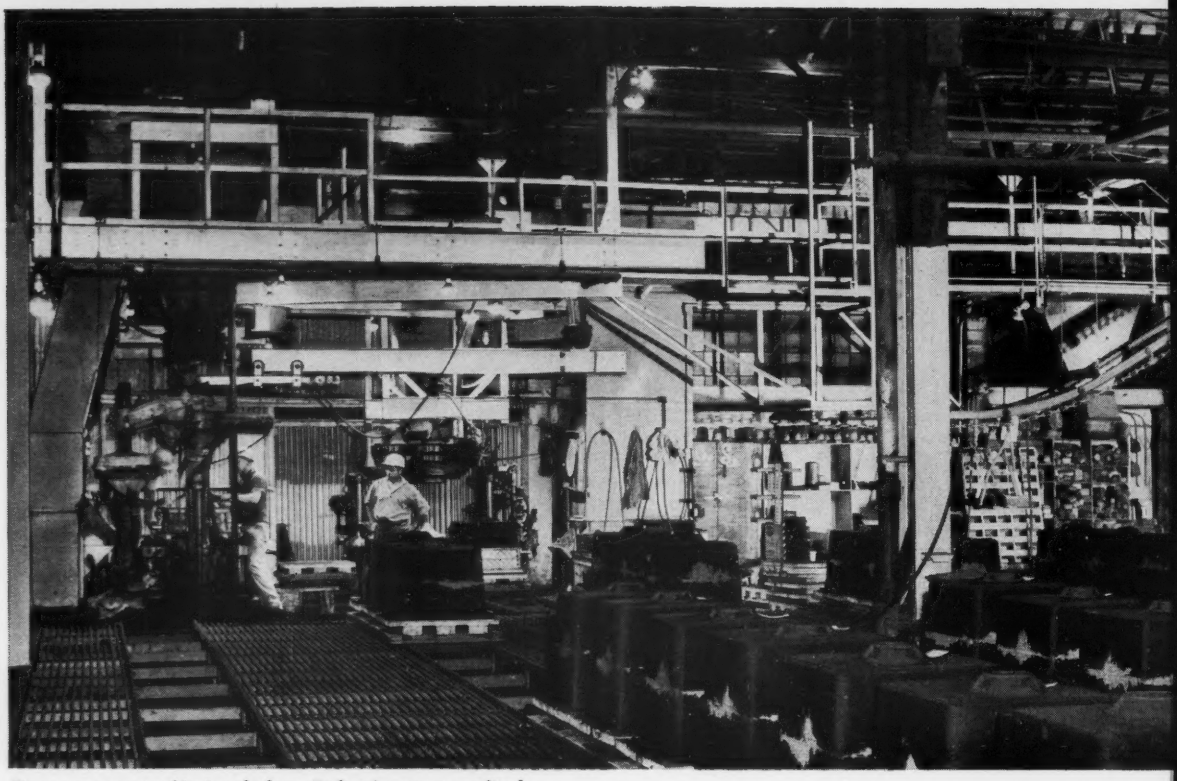


From core room to shipping platform, Dofasco's new, streamlined steel castings department is geared for speed and efficiency.

Quarter Million Dollar Modernization Programme Increases Foundry Capacity

New, streamlined operation speeds output, opens new markets for Dofasco

Hamilton, Ont. Installation of high speed moulding equipment and general streamlining of the steel castings production line is paying off for Dominion Foundries and Steel, Limited with higher volume, greater versatility, and improved customer service.

Mechanization at Dofasco includes a conveyor system from core room to moulding department; as well as transfer cars which carry moulds to pouring platforms and later to an automatic dumper and shake-out machine. Here, foundry sand is reclaimed by passing it through grills and automatically transferring it back to the moulding section.

To begin the cycle, specially prepared and moistened foundry sand is fed from overhead hoppers into cope and drag mould boxes. As they are being filled, the boxes are rapidly vibrated to compress the sand into the desired shape. Final finishing is handled by skilled moulders using specially designed trowels and hand tools. Cope and drag moulds are then united in a "closing" operation preparatory to pouring.

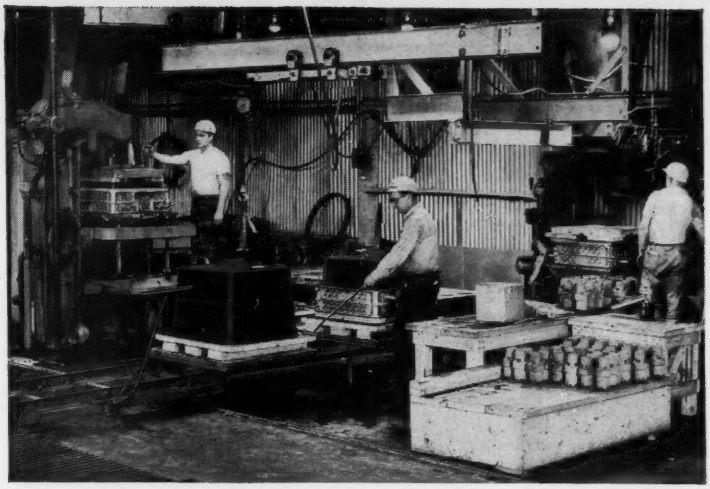
After the moulds are formed they are moved toward the pouring platform and an overhead conveyor system brings new cores from the core room to foundry floor.

When sufficient moulds are ready for filling, molten steel is transported by ladle from nearby Electric furnaces, and the ladleman fills the moulds. Special cars then convey the solid and cooled moulds to an automatic

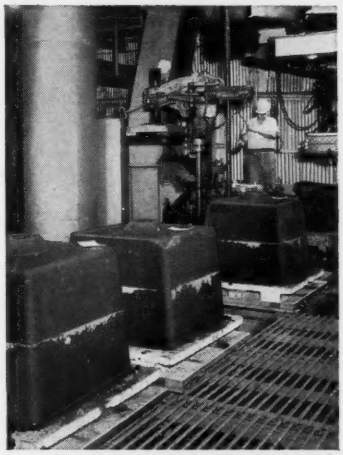
dumper which tips the complete assembly into an automatic shake-out machine. The shake-out is a large unit housing a vibrating steel grill which tumbles the moulds and removes sand from the castings. The sand then passes through the grill and is returned by ducts to the moulding department for refining.

According to Bob Palmer, Assistant Foundry Superintendent, Dofasco's new equipment has sped up the entire operation to a point where more competitive prices and a better delivery schedule can be expected. "The changeover has already brought in new, volume business," said Mr. Palmer. "A large run of steel castings for truck wheels has put the efficiency and precision of the new line to a severe test, and it has passed with flying colours."

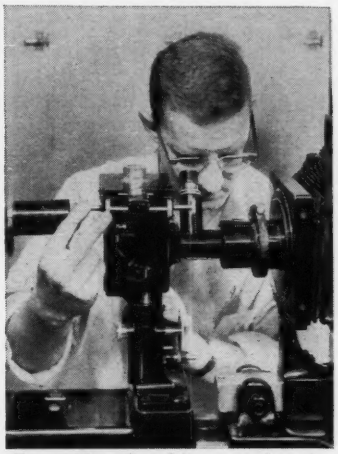
Dofasco metallurgists and engineers work hand in hand with the steel castings division in selecting the right alloys for peak performance and in designing castings for utmost efficiency at lowest cost. Inquiries concerning the new department and its potential should be addressed to Dominion Foundries and Steel, Limited, Steel Castings Division, Depew St., Hamilton, Ontario.



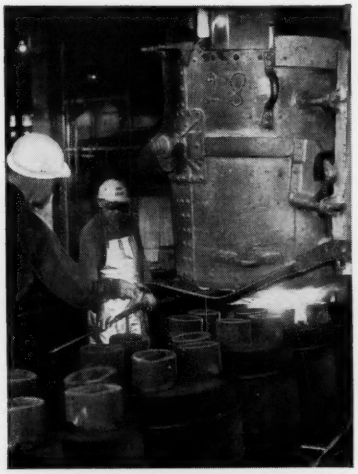
New, automatic moulding units where cope and drag moulds are quickly formed to buyer's specifications.



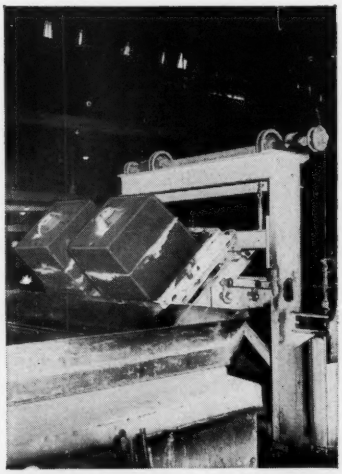
Completed moulds are loaded on transfer cars and rolled to moulding platform located near the Electric furnaces.



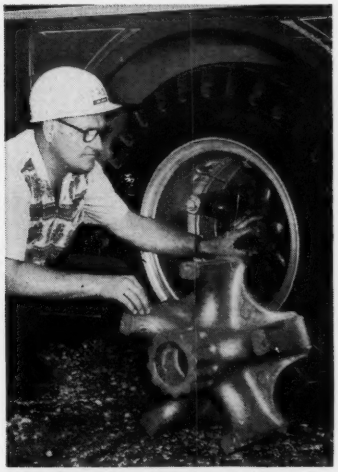
Composition of steel is constantly under laboratory control to assure strict adherence to customer's requirements.



When heat is ready, molten steel is poured into the mould, completely filling it.



When cool, moulds are moved by car to an automatic shake-out machine. Sand is removed from castings, cleaned and returned by overhead ducts to sand storage bins.



Sample product from the new line is this truck wheel. It is later machined to the truck builder's specification and delivered as a completed unit to the assembly lines.

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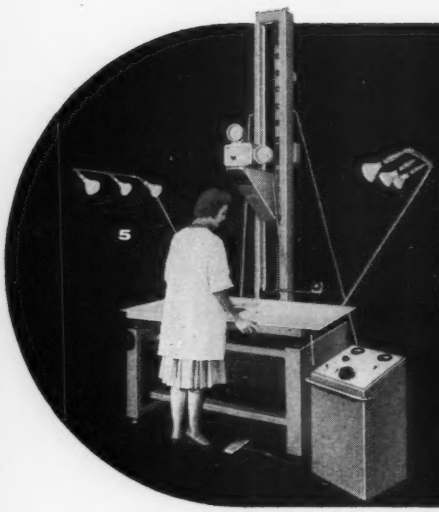

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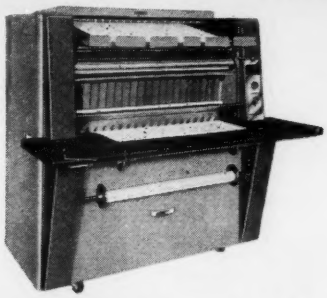
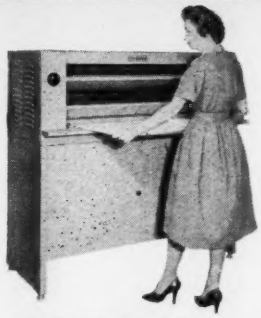


COPYFLEX MODEL 430 . . . a low cost medium volume whiteprinter. It will handle standard 42″ rolls or multiple sheet feedings.



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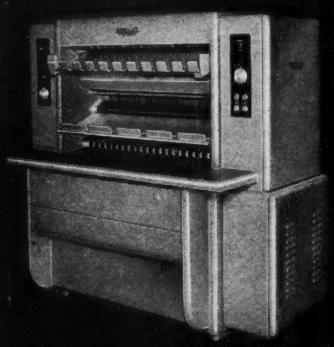

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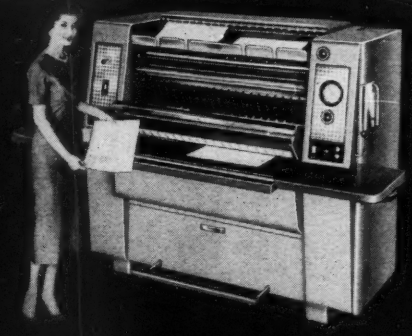

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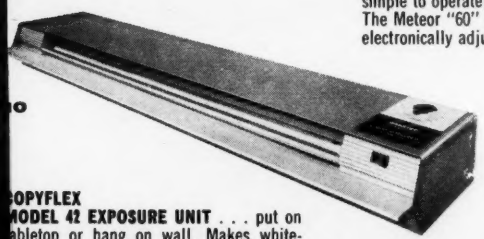

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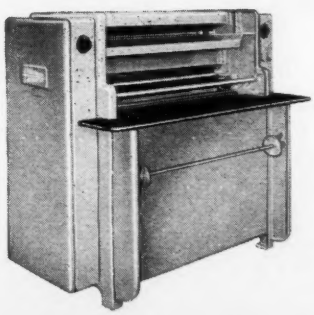

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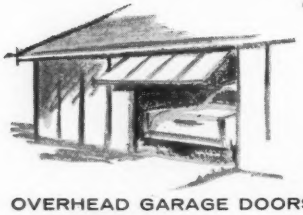
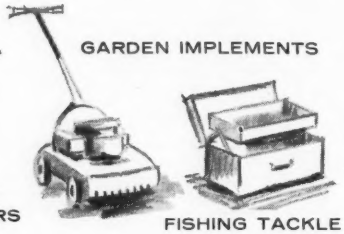
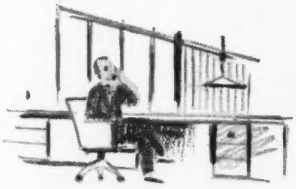
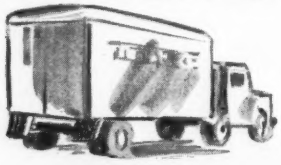

OVERHEAD GARAGE DOORS

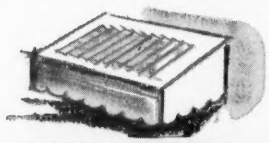

GARDEN IMPLEMENTS

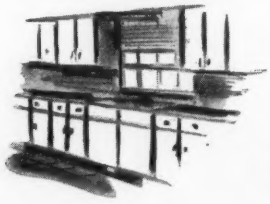
FISHING TACKLE AND TOOL BOXES

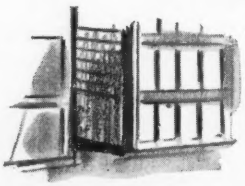

INSIDE PARTITIONS

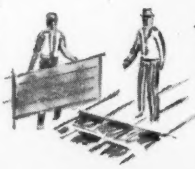

TRAILER BODIES

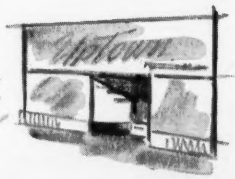
PLAYTHINGS


METAL AWNINGS


KITCHEN EQUIPMENT


BUILDING FACADES


FLOORING



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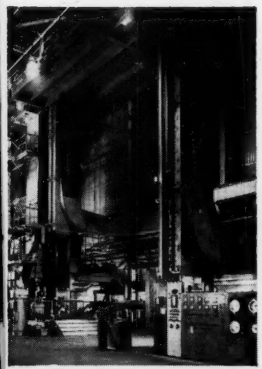
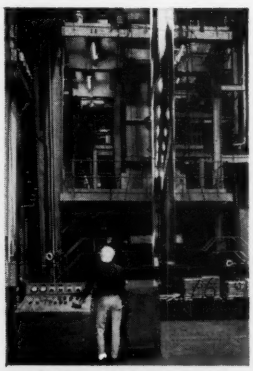
For full information on "Colourbond", in sheets or coils, contact any Stelco Sales Office.



Galvanizing pot and cooling tower of Line No. 1



Zinc coated steel rising from the pot of Line No. 2

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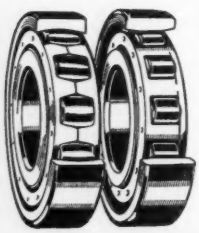

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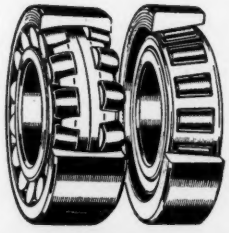

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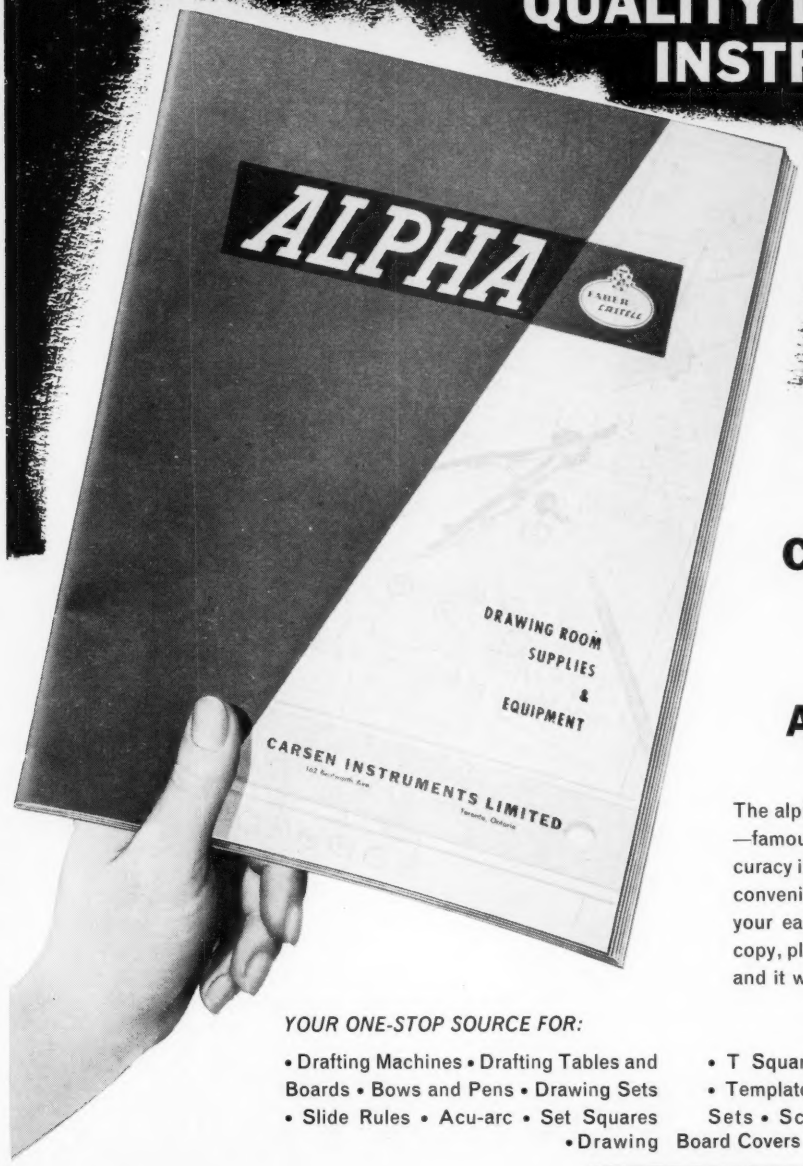

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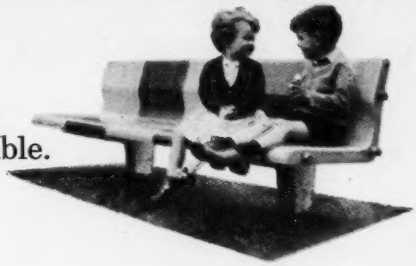

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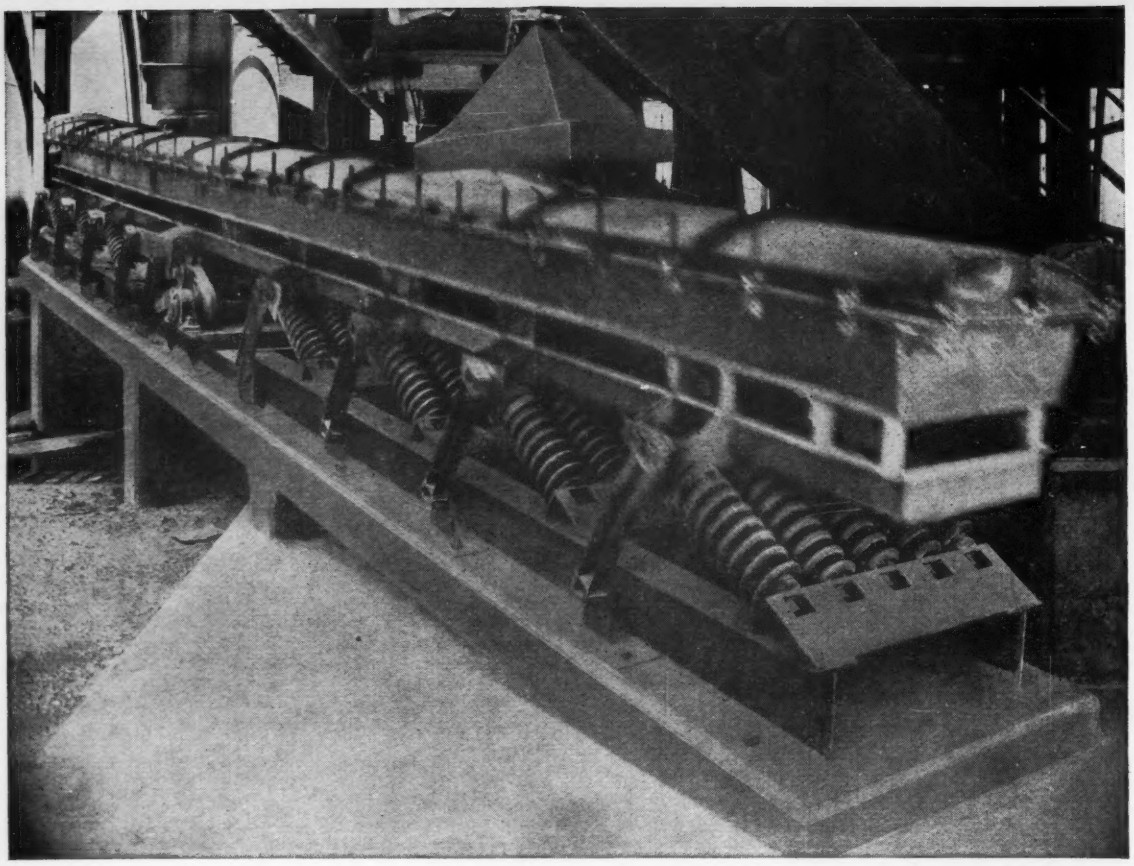

Carrier Vibrating Conveyor at work in the new kraft paper mill of Canadian Rayonier Limited, at Woodfibre, British Columbia.

How to carry hot reburned lime at 1800°F

CARRIER "Natural Frequency" VIBRATING CONVEYORS from United Steel are the obvious choice in such a situation for efficiency, simplicity and long life.

Features of Installation: The conveyor shown here is a United Steel installation designed to move 6 tons of reburned lime an hour, at 1800 degrees Fahrenheit, up a 6-degree incline. At such temperatures only metal conveyors fabricated of heat-resistant materials can function. Alloy steel and stainless steel pans resist warping and high temperature scaling.

This system eliminates drag chains, return runs and dusting.

The unique Carrier vibrating action, a series of pitches and tosses, results in only 20% of the pan wear which would normally occur if the lime was conveyed by conventional methods. The pans, in 5′ long independent sections, preclude thermally induced distortion. Furthermore, the Carrier has only one set of moving parts – the patented positive eccentric drive assembly, which is extremely simple and needs only the rarest attention.

The Conveyor pans in this installation have been enclosed by overlapping domed covers, suitably gasketed to prevent lime dust from escaping. Like the troughs themselves, these covers are designed so that the thermal expansion and contraction do not interfere with function.

United Steel welcomes *your* challenge on a tough materials handling situation – any kind, anywhere.

United Steel
CORPORATION LIMITED

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from the Engineering Team at Wallace Barnes.

These are just a few examples of the many thousands of different springs produced by Wallace Barnes in lots of a few . . . or thousands. The successful production of this large variety depends on the knowledge and experience of the Wallace Barnes team of engineering experts. These men, skilled in every phase of spring-making, guarantee the most efficient design, the most durable product, and the most economical production in any quantity.

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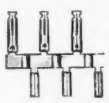

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VE Air Ring Clutch and Brake — Bulletin 500-A2

E Air Ring Clutch and Brake — Bulletin 500-A2

ER Clutch and Brake Bulletin 500-A2

EB Clutch and Brake Bulletin 500-A2

CT Brake — Bulletin ML-182

Single Passage Rotorseal Bulletin ML-177

Timing Rotorseal Bulletin ML-177

Quick Release Valve Bulletin ML-177

Cam Limit Switch Bulletin 500-A2

Flexline Clutch Control Bulletin ML-193

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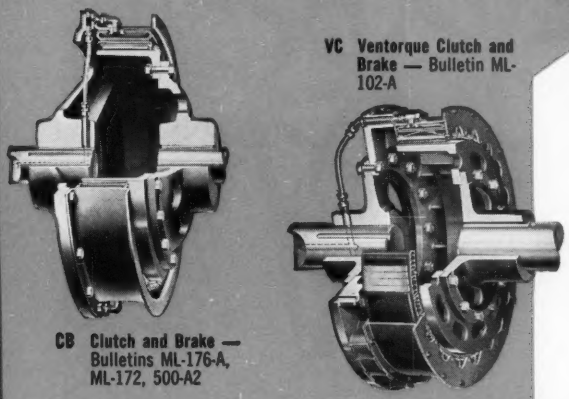
designer's pool of power transmission products

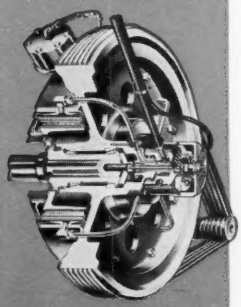


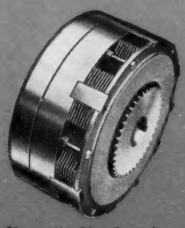
VC Ventorque Clutch and Brake — Bulletin ML-102-A

CB Clutch and Brake — Bulletins ML-176-A, ML-172, 500-A2

FSPA (Fawick Standardized Press Application) Bulletin ML-172, 500-A2

Standardized CB Clutch Package Applications — Bulletins ML-176-A, 500-A2





Liqui-Cool Clutch and Brake — Bulletin ML-181

Magnetic Clutch and Brake — Bulletin M-105S

FAWICK can provide you with components for the best performance in power transmission.

FAWICK plants produce a complete line of clutches, brakes and controls—air-actuated constricting and expanding types, and magnetic types—ranging in size from 2½ to 84-inch diameters, with torque ratings from 27 to 3,000,000 inch-pounds.

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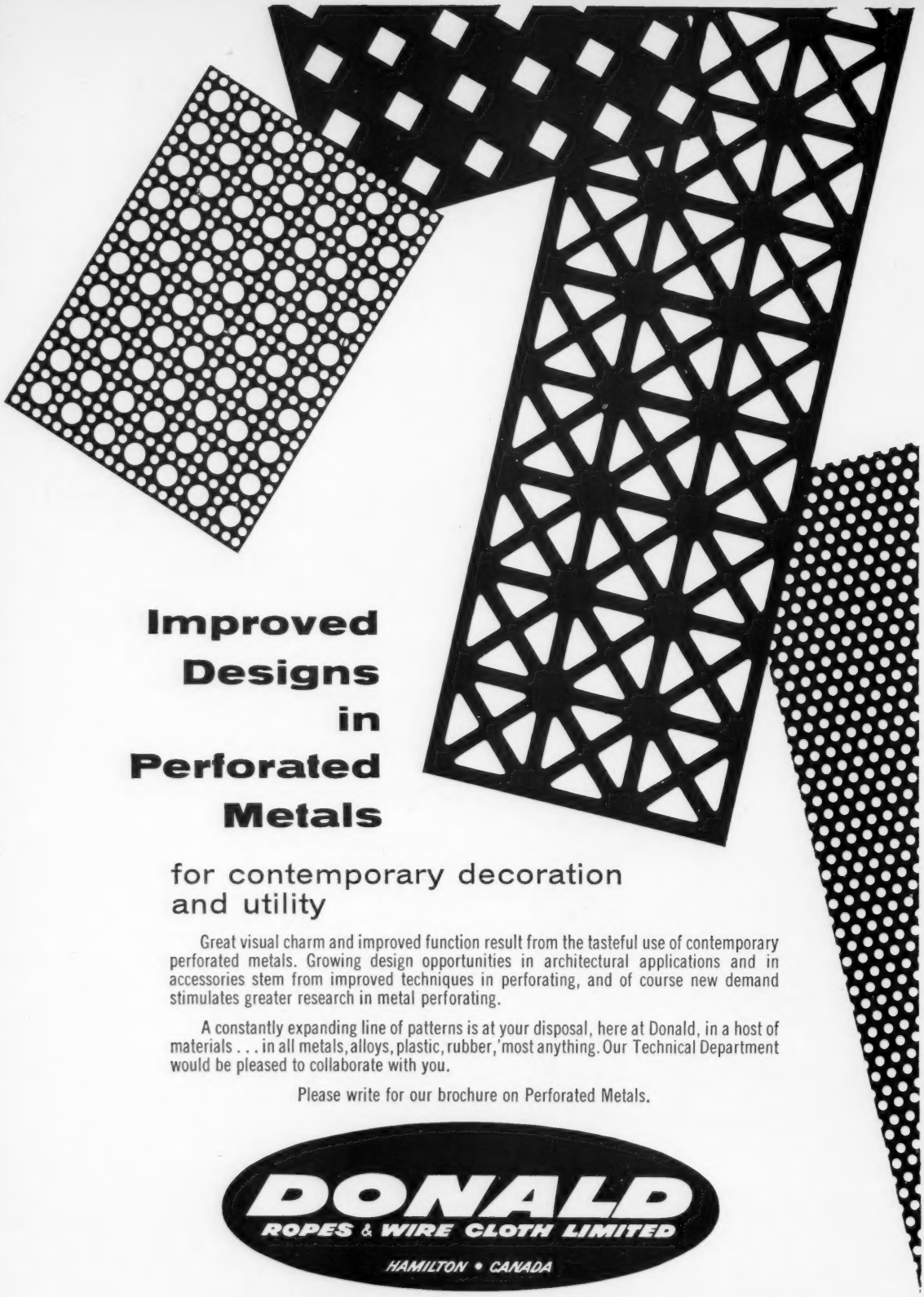

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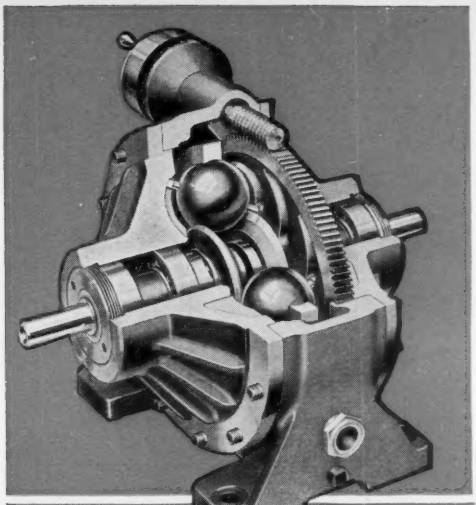

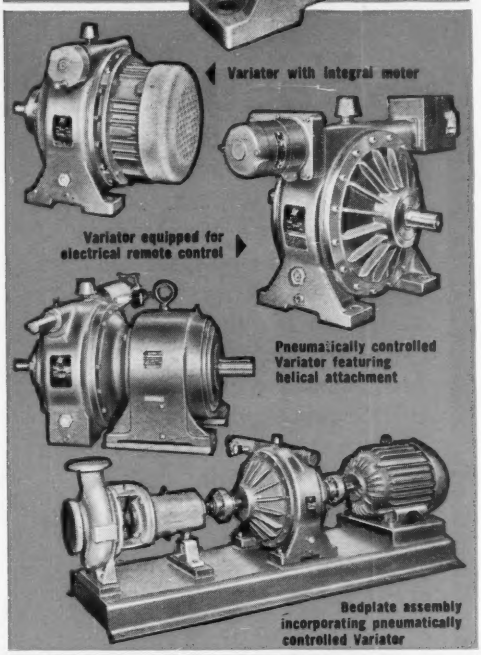
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for accurate, dependable, infinitely variable speed control, specify...

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Exclusive Variator advantages:

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- Almost any input speed up to 1800 RPM can be used—either clockwise or counterclockwise rotation.
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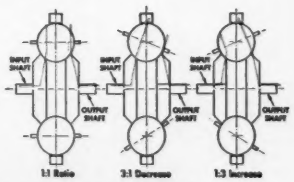
Power is transmitted from input shaft to output shaft — rotating in the same direction — through alloy steel driving balls which are in pressure contact with the drive discs. Relative shaft speeds are adjusted by changing position of axles on which the balls rotate.



CLEVELAND SPEED VARIATOR

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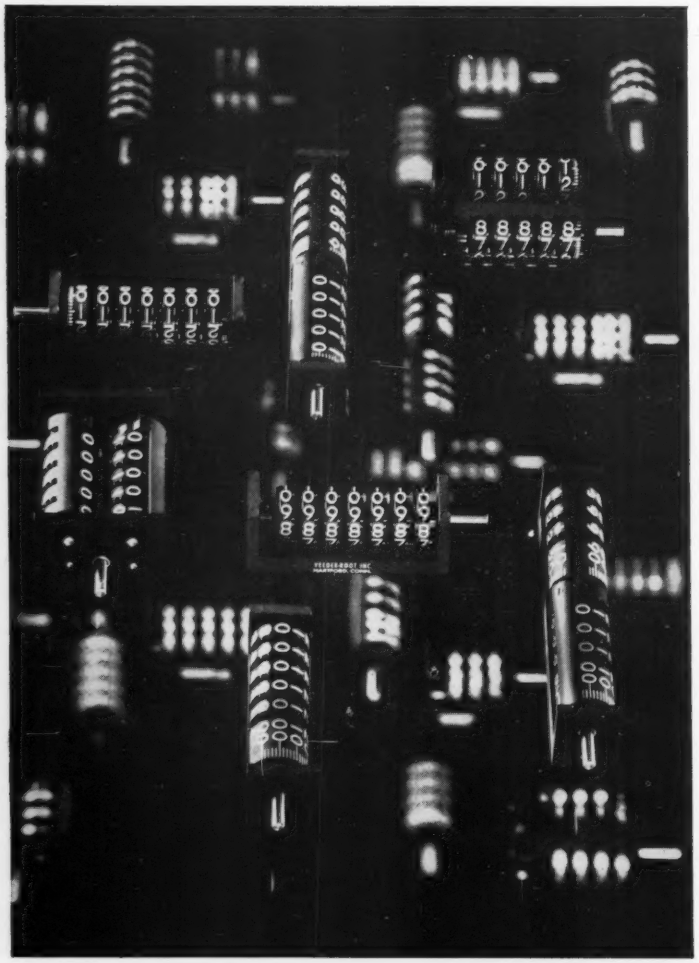
Veeder-Root announces Veederline:



108 versatile counters
for military, commercial and industrial applications.
Veederline sets a new standard in direct-drive high-speed counters.
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Veederline — a new range of single, tandem and dual counters.

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68 single counters
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from a fixed reference
in either direction.

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Low torque, low inertia, all rotations.

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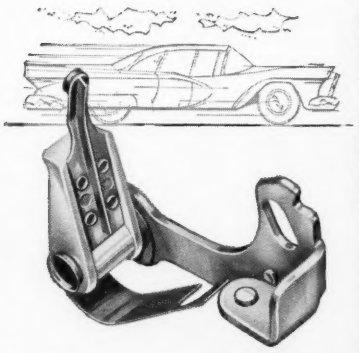
Lowest Cost Fastener You can buy

Low initial cost per thousand, low installed cost with highly engineered high speed United Eyeleting machines, and you have an unbeatable combination you can put to work saving money. They will join dissimilar materials, can be clinched tightly to fasten, or lightly to function as a pivot.

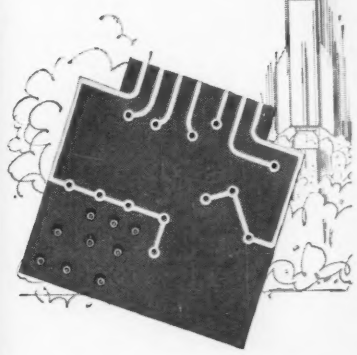
They can be used as a bearing, or as a terminal. With ceramics, plastics, and glass special machine device helps minimize fracturing. You can get them from stock in a wide range of sizes, colors, and metals. A host of special diameters, lengths, shapes can also be made to solve your individual problem.

See our catalog in Sweets' Design File or write us today to investigate the possibilities of utilizing lowest cost United Eyelets for your product.

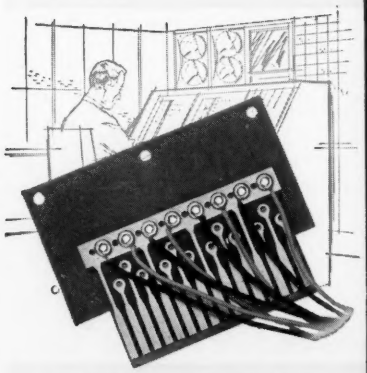


High speed fastening of 2 eyelets simultaneously cuts costs on automotive ignition breaker point assembly.

Eyelet does double duty as fastener for wind shield, bearing for spark wheel. Does both jobs well for only a fraction of a cent.

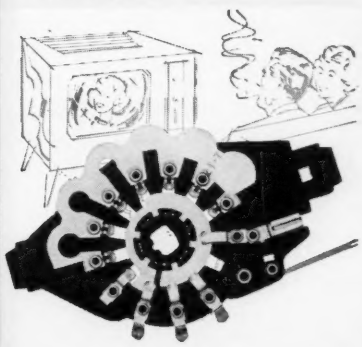


For high altitude or on the ground, funnel flange eyelets provide positive means for making reliable thru-connections on two-sided printed wiring boards.



JUST plug it in — United Standardized eyelets hold wires by compression on multi-contact computer part. Tight hold eliminates soldering time and bulk.

Before you say "hello", eyelets are working for you on our most popular method of communication. Try them on a new application — perhaps they'll prove as indispensable as your telephone.



You can avoid the inevitable commercial with the T.V. Selector Switch and still enjoy the silent utility and performance of eyelets on the switch itself.

Free Eyelet Slide Selector helps determine which eyelet you need with given grip and hole diameter.

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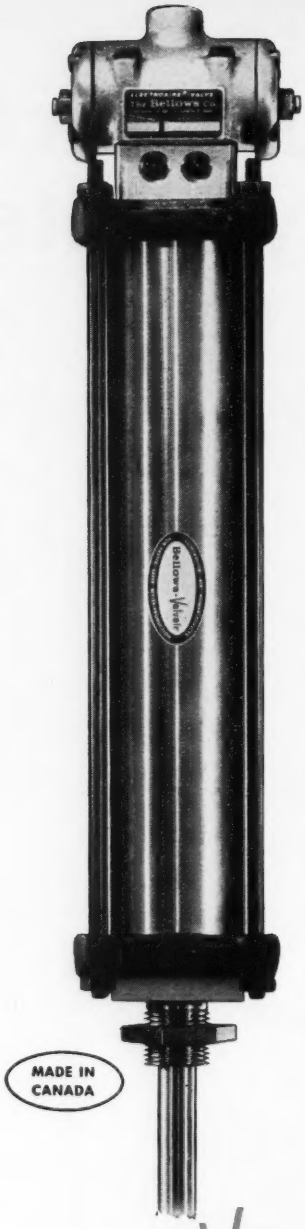
Design with Air in Mind

The range of control systems available with the Bellows Air Motor® (the air cylinder with the built-in valve) gives the engineer a flexibility in design that not only lessens his work but enables him to build his machine at lower cost. Not only to build it at lower cost but to build it to perform more efficiently and at lower cost to the user.

Wherever a push, pull, lift or turn motion is performed by mechanical means, such as cams, gears, levers or linkages, you'll save all the way down the line—**by designing with air in mind.**

Technical representatives of Bellows-Valvair, Ltd., are located in all major Canadian cities. They will be happy to work with you in applying economical air power to your specific projects. Or, write direct for copies of Bulletins BM-25 and FP-62. Address Dept. DE-1161.



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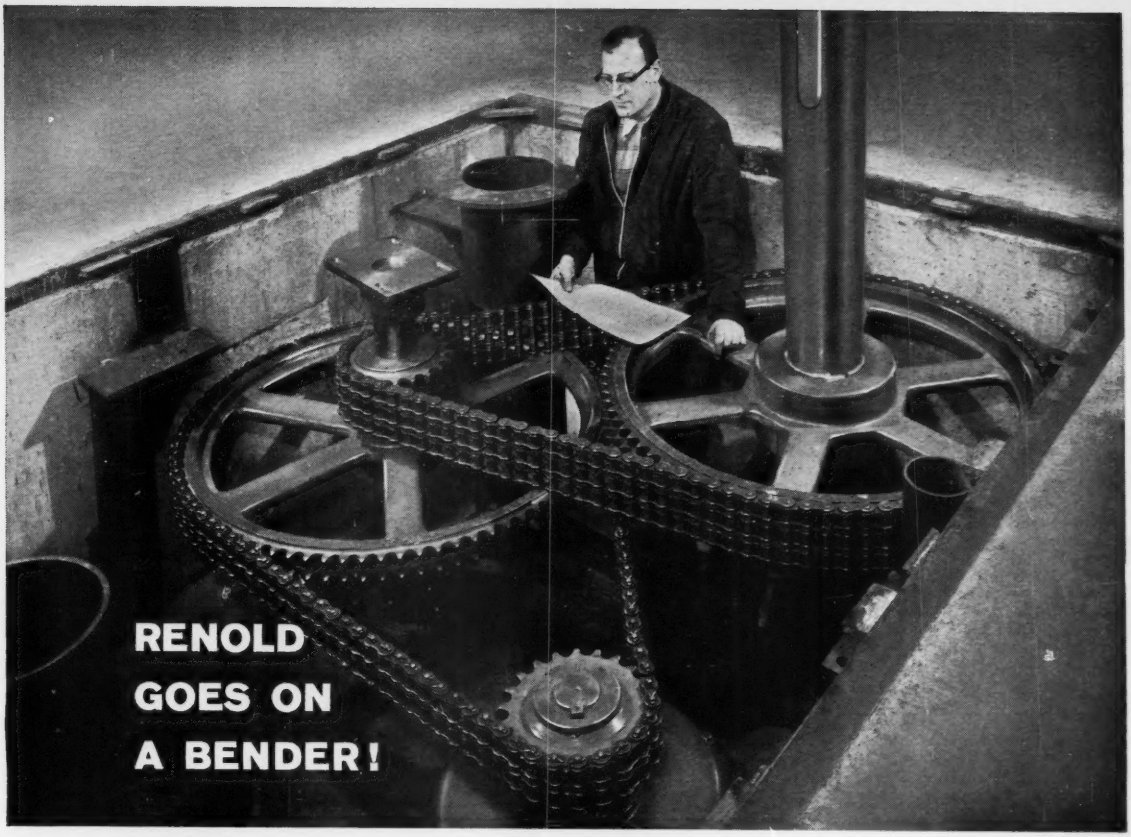

Crane Piping Ltd., Hamilton, uses this machine to bend 36 inch diameter fabricated steel pipe. Its power comes from a Renold Roller Chain Drive and Holroyd Speed Reducer and Renold Coupling —supplied by Renold Chains Canada Ltd.

It does the job efficiently and economically—and, most important, it's designed to do its heavy work for years with a minimum of maintenance.

A 17 h.p. 900 r.p.m. motor is connected by a Renold flexible disc coupling to a Holroyd 60 to 1 vertical reducer. Renold duplex and triplex chain drives, using 21 tooth and 84 tooth sprockets, then reduce the speed still further, to give a total reduction of 960 to 1, with corresponding torque multiplications.

This unique application of Roller Chain meant a major dollar saving to Crane Piping Ltd. The use of a conventional double reduction speed reducer—the only alternative to the chain drive—would have *more than doubled* the cost of the machine.

Throughout Canadian industry, specialized power transmission problems can be solved *most efficiently* and *more economically* with experienced, qualified help. For assistance with *your* installations, call Renold—first name in power transmission!

RENOLD CHAINS CANADA LIMITED

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When should you use Mercury-Wetted Contact Relays?

IF YOUR RELAYS MUST

SWITCH UP TO 100 TIMES PER SECOND

HAVE A LIFE IN EXCESS OF A BILLION CYCLES

BE COMPLETELY RELIABLE AND FREE FROM CONTACT BOUNCE

THEN SPECIFY P&B MERCURY WETTED CONTACT RELAYS

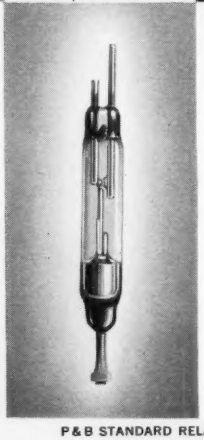
An unusual combination of advantages found only in mercury-wetted relays has led many design engineers to specify them for tough switching jobs. Here are but 3 typical characteristics of our JM series:

RELIABILITY. Sealed-in-glass mercury contacts are renewed with every operation. Won't pit or weld. Make or break is positive . . . every time. No bounce, no chatter. Signals ranging from a few micro amps to 5 amps are switched with singular consistency.

LONG LIFE. Think in terms of *billions* of operations when considering JM series relays. Proper application, of course, is a requisite.

SPEED. Operate time is just less than 3 milliseconds using 2 watts of power. Release time is about 3.2 milliseconds. Thus, relays can be driven 100 times per second.

If your project calls for exceptional relay performance, perhaps the answer lies in our JM Mercury-Wetted contact relay.



JM SERIES ENGINEERING DATA

Contact Rating:
5 amperes maximum
500 volt maximum
250 volt-amp max. with required contact protection.

Contact Configuration:
Each capsule SPDT. Combination of capsules in one enclosure can form DPDT, 3PDT, 4PDT. (All Form D.)

Terminals:
Plug-in or hook solder; 8, 11, 14, or 20-pin headers.

Coil Resistance:
2 to 58,000 ohms.

More information?
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P&B STANDARD RELAYS ARE AVAILABLE AT YOUR LOCAL ELECTRONIC PARTS DISTRIBUTOR

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YOUNG MAN WITH A HORN: Because it's quick to mount, easy to adjust from a blast to a whisper, weather-proof, and long-lived, the **EDWARDS ADAPTAHORN** is popular in industry, schools, institutions and similar applications. Amp for amp, it's the loudest horn on the market—isn't it, young man? Edwards of Canada Limited, Owen Sound, Ontario. Branches across Canada.

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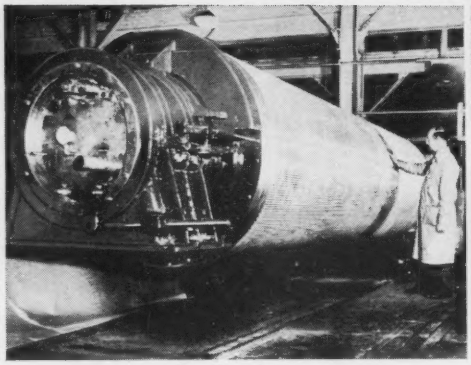
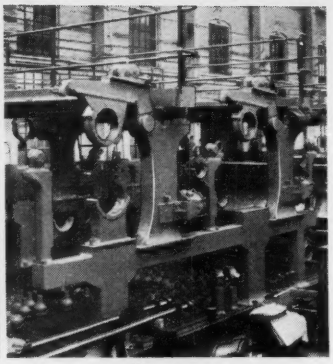
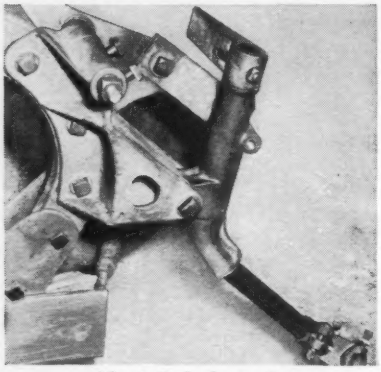
12" pipe



Cantilever head



Press arms



Plow tail wheel mounting

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the **versatile** cast iron that can be bent

- **good ductility**
- **high strength**
- **good machinability**
- **controlled hardness**
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Ductile iron shows its versatility in many ways, not only with outstanding mechanical and physical properties but also with the process advantages of grey cast iron; it can be cast into intricate shapes.

Alloyed grades of ductile iron containing nickel provide increased strength and yield, along with controlled hardness through heavy sections.

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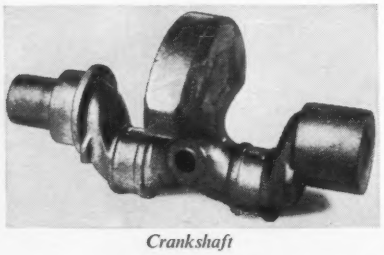
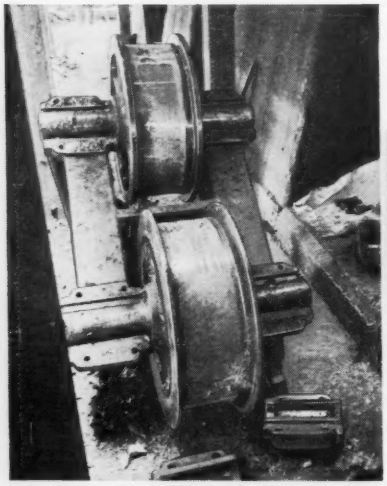
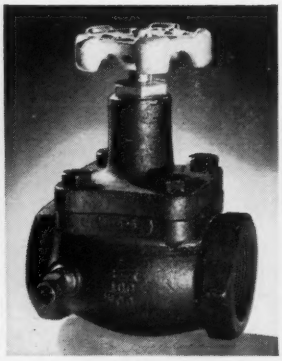


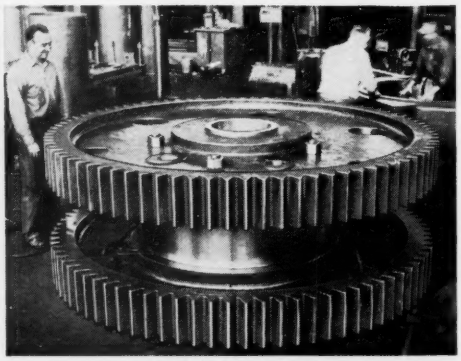
Crankshaft



Barking drum rollers



Valve



Nickel-alloyed gears

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Replace old-fashioned couplings with Rockwell-Standard's

BLOOD BROTHERS

HEAVY-DUTY INDUSTRIAL DRIVE LINES

ROCKWELL-STANDARD ENGINEERS specifically designed Blood Brothers Heavy-Duty Industrial Drive Lines to replace couplings in industrial applications. They improve machine performance and efficiency...last longer... give better service than any coupling. They often reduce costs by eliminating the need for bearings and supports required by conventional coupling installations. Wearing parts are quickly replaced and even drive lines can be replaced in 15 minutes!

Available in capacities up to 500,000 torque inch pounds, they are adaptable to a variety of applications—rolling mills, oil field equipment, irrigation pumps, cargo carriers, marine drives, logging winches, mining machinery and many others.

Blood Brothers Industrial Drive Lines offer these special features:

• Wing bushings that eliminate costly flange yokes and reduce down time during servicing. Simply remove 8 bolts for complete disassembly • Sliding spline provides for quick, easy assembly—variations in mounting locations—longitudinal shaft movements during operation—deflections and temperature changes • Easy access to lubrication fittings.

Another Product of...

ROCKWELL-STANDARD CORPORATION

ROCKWELL R STANDARD

Universal Joint Division, Allegan, Michigan

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WE BROKE A DOZEN SCREWS, BUT

we couldn't make this sheet metal insert spin in its hole!

THE INSERT PROBLEM

A hole punched in thin sheet metal doesn't provide enough surface for threading. You often have to supply the threads by installing an insert.

But the same hole doesn't provide much surface for *gripping*, either. The insert spins.

WHAT WE DID ABOUT IT

The insert we tested was designed with an *angular* knurl around a cone-shaped gripping perimeter. Here's what happened:

First: When we mated the sheets, put in a screw, and tightened it in the insert, the screw pulled the insert toward the sheet. It also pulled the teeth of the angular knurl more firmly into the edges of the hole, increasing their resistance to spin.

We broke screws (No. 8, 10, 12, and ¼ sizes) by overtorquing them. But the only effect on the insert was to tighten it.

Second: When the insert was first pressed into the hole, the angular knurl displaced metal, squeezing it toward and into a groove around the bottom of the insert. This locked the insert against being pushed out before the screw was tightened. After tightening, the lock was intensified by the added squeezing pressure of the angular knurl.

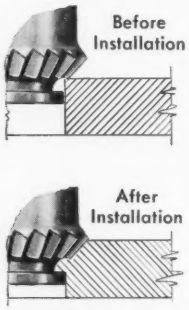
WE'LL SEND SAMPLES

If you've had this insert problem, drop us a line on your letterhead. We'll send some Southco THREDS (that's their name) for you to try. No obligation, of course. Write to your nearest distributor listed below.

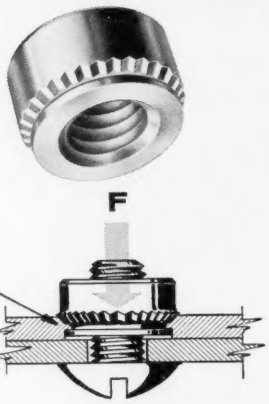
THREDS . . . AND THE ANGULAR KNURL PRINCIPLE

Southco THREDS are installed by pressing into a single hole in the sheet, provide thread length equal to or greater than that of a standard nut. One insert fits any sheet thickness (see minimum requirement, last column in table below). Material is case hardened steel, Cad. plated per Fed. Spec. QQ-P-416 Type II, cl. 2, yellow iridite.

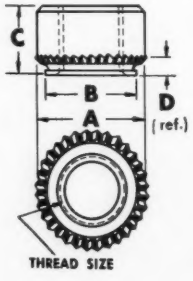
ANGULAR KNURL
(detail)



Teeth bite into edge of hole, force metal into locking groove at base of insert.



Additional torque on screw increases force F, pulling teeth of angular knurl more firmly against sheet and putting extra pressure on metal in locking groove G.



SOUTHCO THREDS[T.M.] . . . SPECIFICATIONS

THREAD SIZE	PART NUMBER	A	B	C	D	Weight per M (lbs.)	Min. Sheet Thickness
4-40 NC	74-11-104-13	7/32	.185	5/32	3/64	1.22	.036
6-32 NC	74-11-106-13	9/32	.247	5/32	3/64	1.99	
8-32 NC	74-11-108-13	5/16	.278	3/16	3/64	2.87	.048
10-24 NC	74-11-110-13	5/16	.278	3/16	3/64	2.51	
10-32 NF	74-11-210-13	5/16	.278	3/16	3/64	2.53	
12-24 NC	74-11-112-13	13/32	.372	3/16	1/16	4.56	.060
¼-20 NC	74-11-125-13	13/32	.372	3/16	1/16	4.28	
¼-28 NF	74-11-225-13	13/32	.372	3/16	1/16	4.32	

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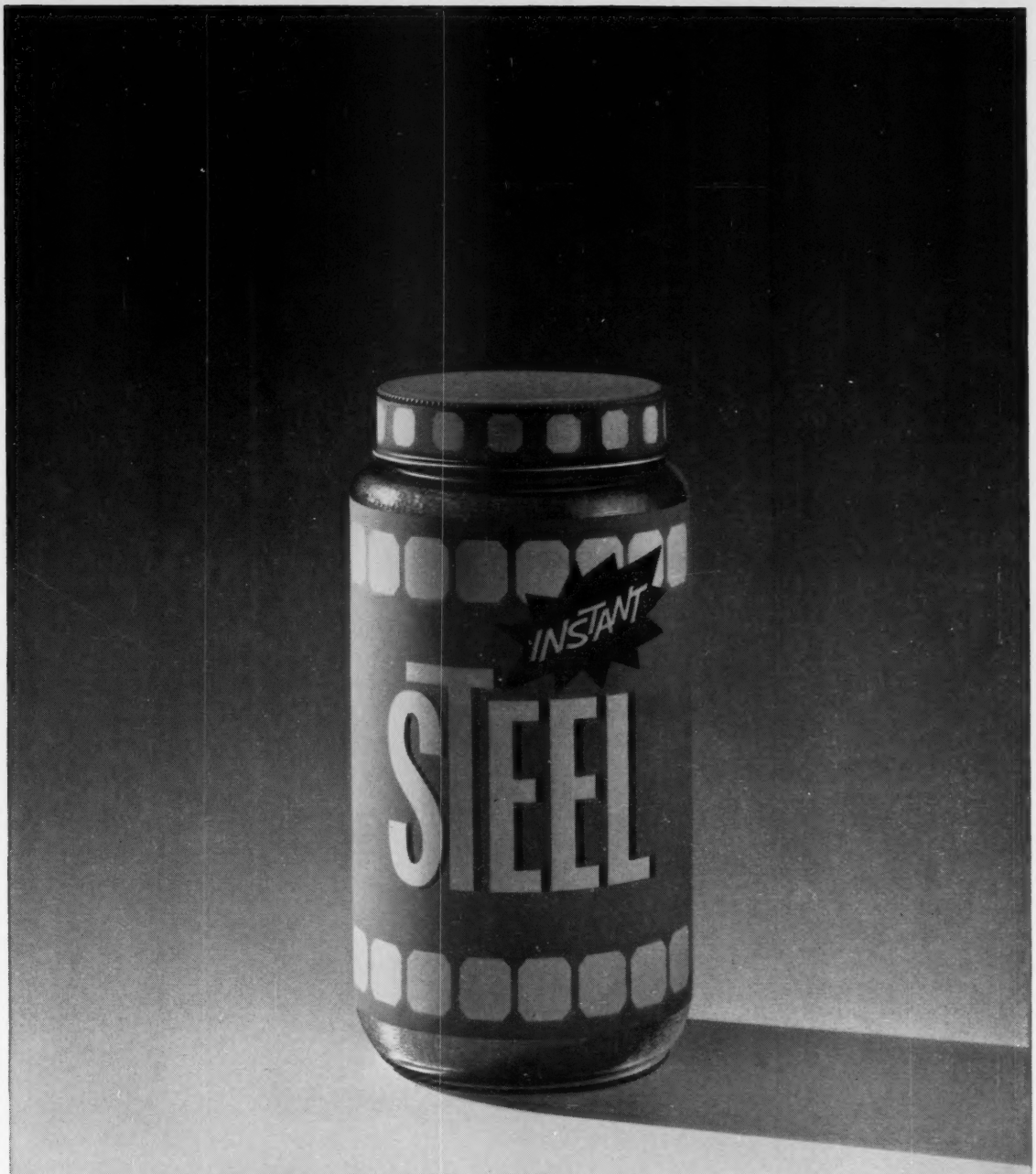

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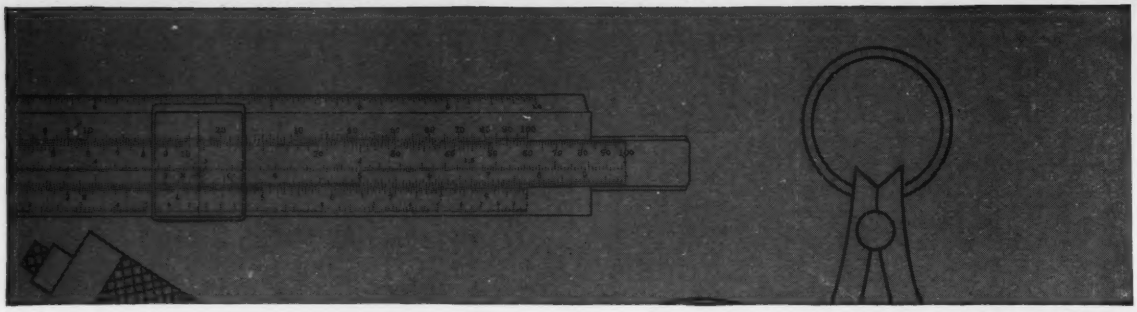
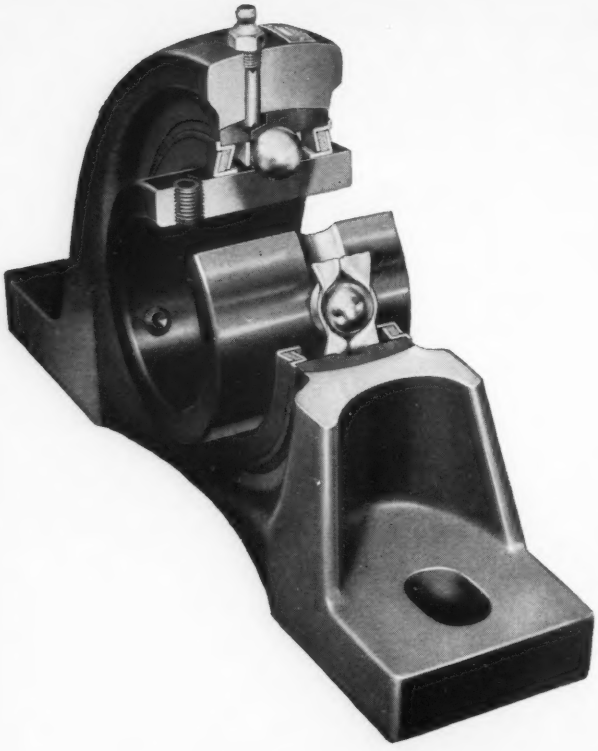
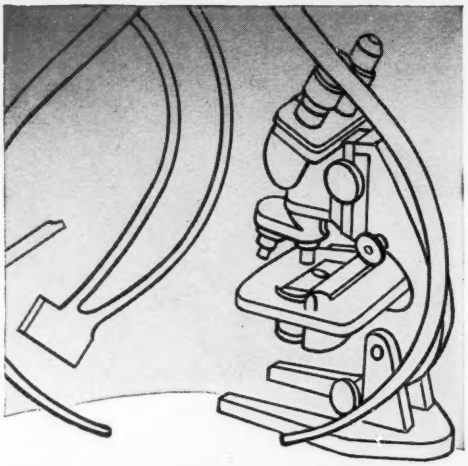


SYMBOLS OF PRECISION





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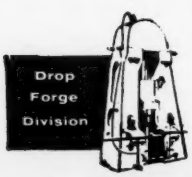

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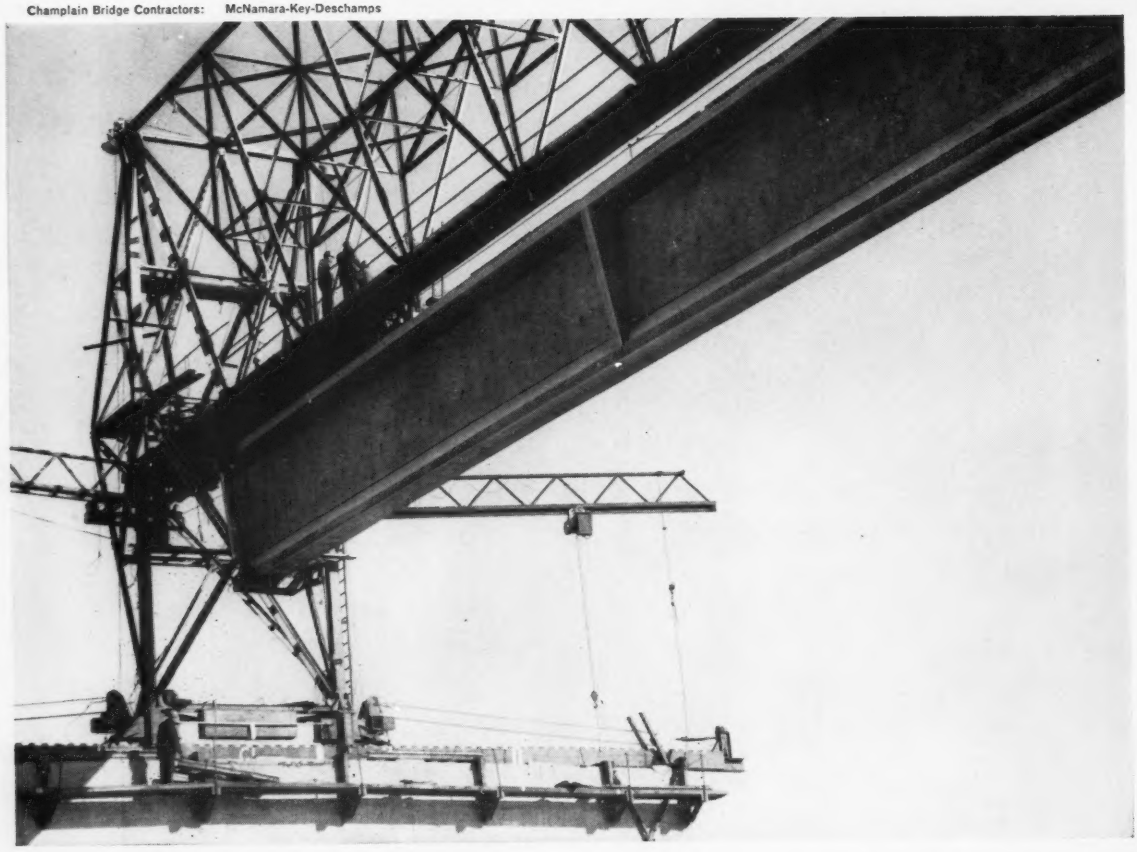

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The photo shows the positioning of a 176' long, 10' high, 176-ton prestressed concrete beam on Montreal's new Champlain Bridge across the St. Lawrence. Making light of this ponderous job is a hydraulic system produced especially for the job by Jarry Hydraulics Limited.

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Northern Electric Research and Development Laboratories built a floating anechoic chamber. Although the appearance of this room is weird, its purpose is perfection; for here, there are no echoes, reflections or vibrations to distort the accuracy measurements of sound waves. ■ Wedges of Fiberglas, five feet long, project towards the middle of the room from all six surfaces, so that the equipment under test is completely surrounded by a mass of sound absorbent material. ■ This anechoic chamber is being used to test microphones, speakers, telephone transmitters and receivers, intercom systems and other communications equipment. ■ The chamber is an important new asset, but it represents just a fraction of the total facilities and personnel dedicated to the quest for progress in communications at the Research and Development Laboratories of Northern Electric Company Limited.

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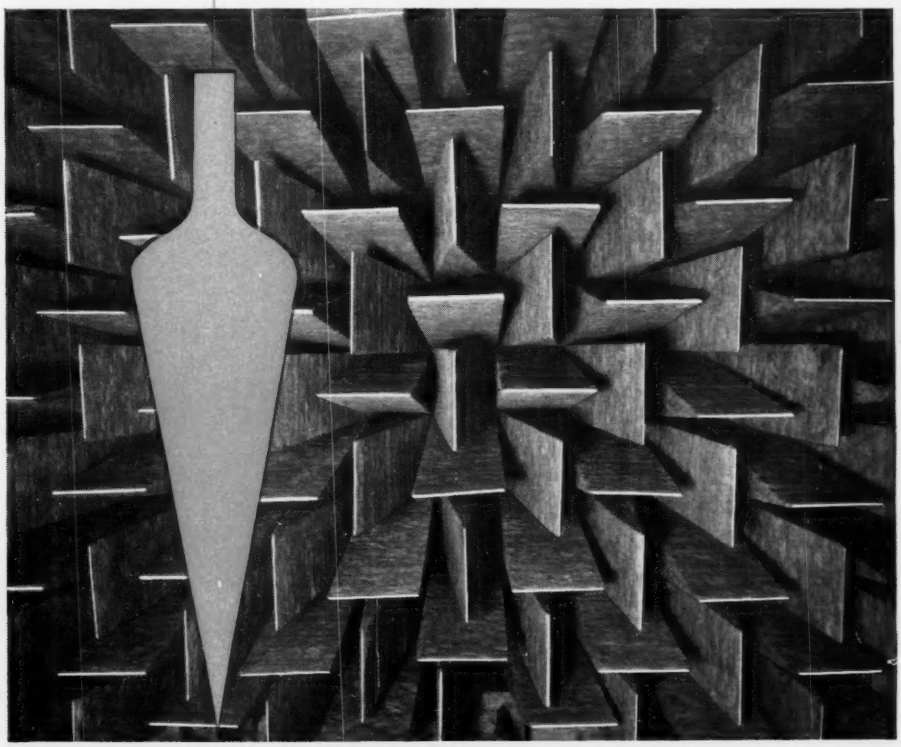

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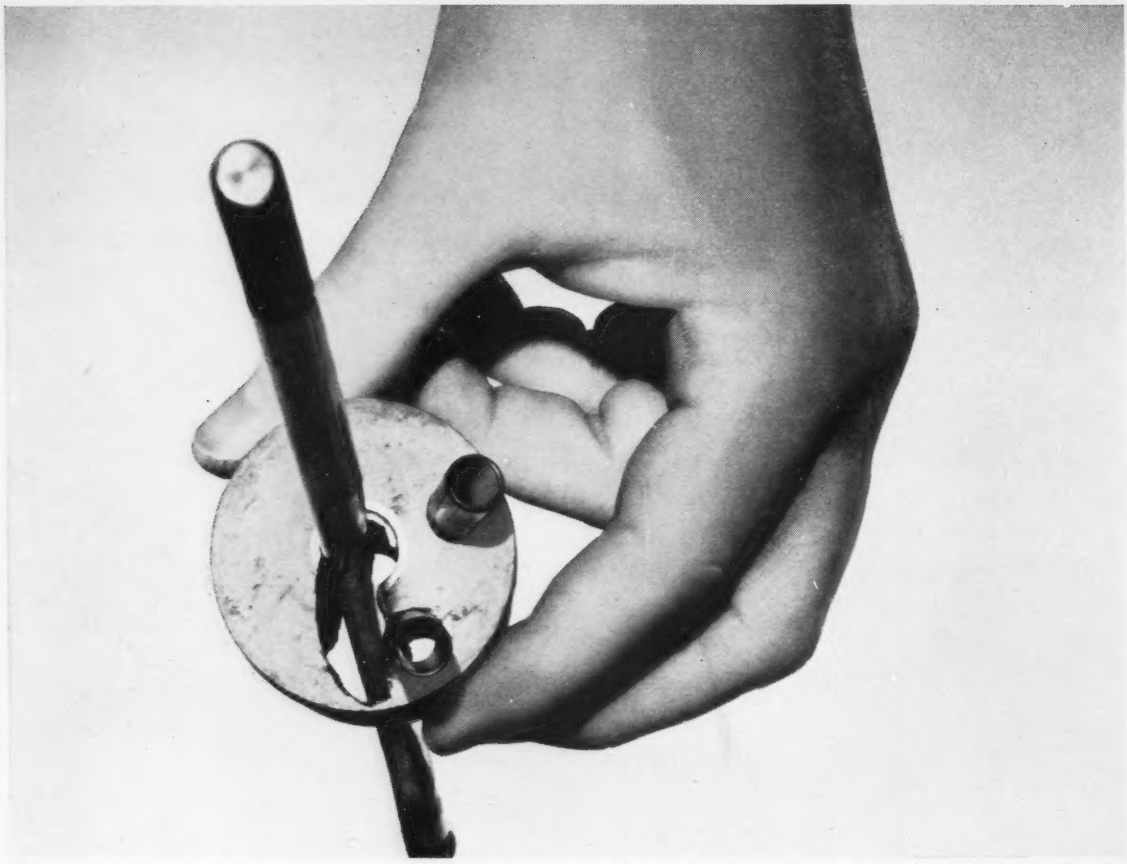
Wear like this led to replacement of 7 metal parts by ADIPRENE

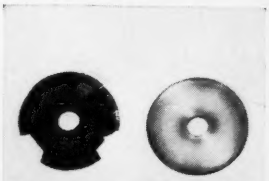


Highly abrasive glass dust caused this reciprocating rod to cut entirely through a metal bearing and most of the cylinder rod end plug in a UNIFIL® loom-winder used in glass fabric weaving. An ADIPRENE bearing was still performing well a year later, after more than 200 million strokes

ADIPRENE® still at work after 200,000,000 strokes...on a job too tough for metal bearing

Tiny glass particles ground gaping holes in vital metal parts on glass fabric weaving equipment. An obvious solution was substitution of non-metallic parts. But when conventional rubbers and plastics were tested, failure again occurred. ADIPRENE urethane rubber, however . . . with its excellent resistance to abrasion, plus its combination of hardness, resilience, and load bearing capacity . . . tested so successfully that now seven ADIPRENE parts are used in the same loom-winding machine. These parts reduce downtime and increase quality by making possible continuous runs of the glass fabric.

ADIPRENE can help you in the design of better, longer-lasting parts. It is oil-resistant, machinable and has outstanding electrical properties. For detailed information on the unusual combination of properties of ADIPRENE, write Du Pont of Canada Limited, Elastomers, 85 Eglinton Avenue East, Toronto 12, Ontario.



Conventional rubbers were also tested for textile machinery parts. ADIPRENE far outlasted all metals, plastics and rubbers.

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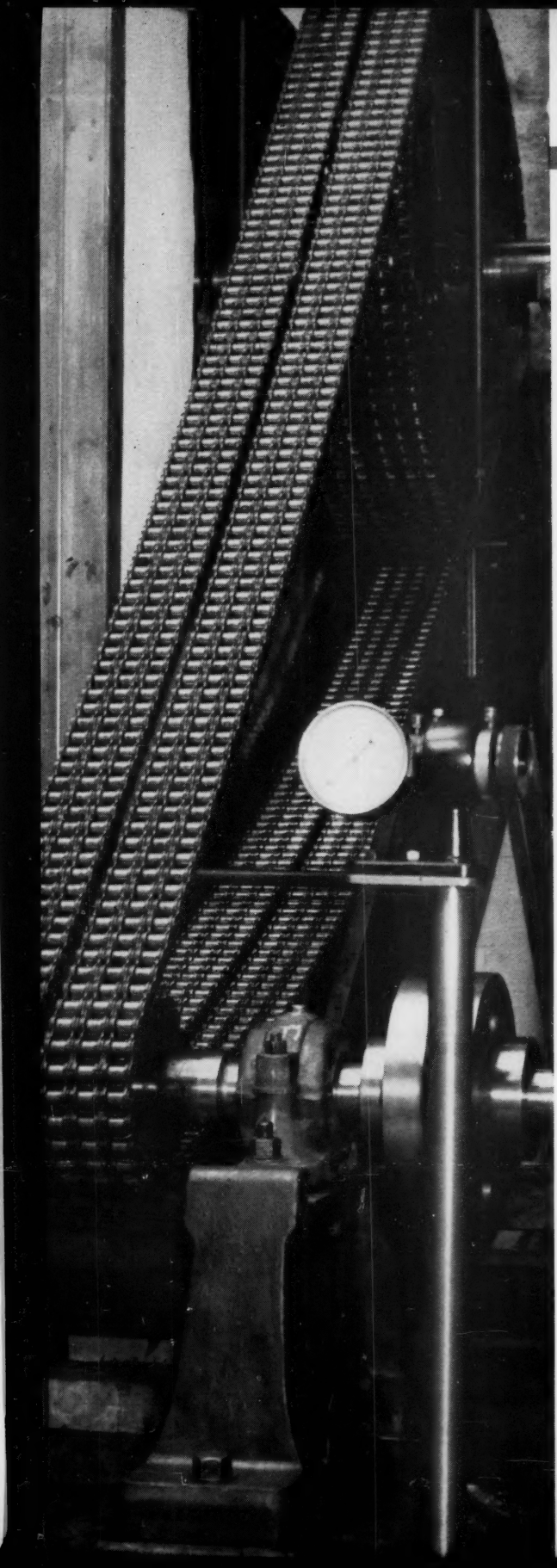


Design Engineering

November, 1961

8 case histories show versatility of roller chain drives

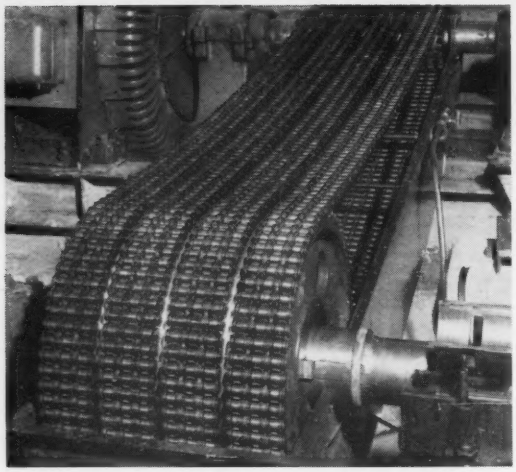
The precision steel roller chain is one of the most versatile and efficient methods for transmitting mechanical power. Inherent in the roller chain drive are the features of positive transmission without slip, high mechanical efficiency throughout entire life, exceptional robustness and resistance to wear. Consequently, when applied to the wide range of industrial requirements, equality of performance to adequate standards is assured.

An infinite variety of machinery functions is covered due to the adaptability of roller chain to widely divergent types of layout incorporating more than one driven wheel. Considerable economy of space may be also effected by use of roller chain, the compactness of chain drives being a useful feature in machine design where transmissions are an integral part, and for plant work where space is restricted.

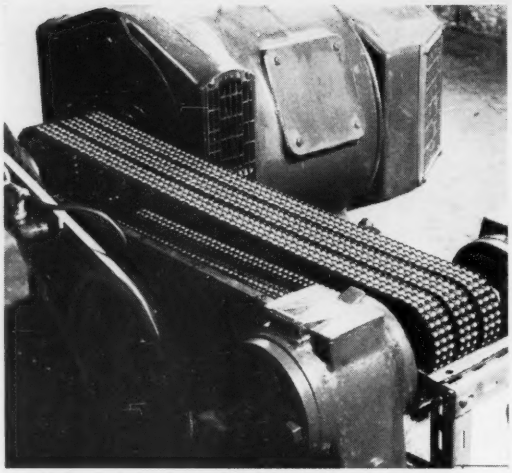
In the United States the dimensional and physical properties of roller transmission chain are laid down in ASA B.29.1—1957, and multiplex chains up to eight rows of rollers are in common use. European practice conforms to British Standard Specification 228-1934 and the equivalent German Standard DIN 8180-1956, and French Standard AFNOR NF.E.26-101-1957. Here the chain widths are restricted to single, duplex and triplex which may, however, be employed in multiple strand formation. Canadians use the ASA standards.

Chain drives cover the entire range of motor speeds and powers commonly met with in industry up to 4,000 hp at 300 rpm or 5,000 rpm at 650 hp. They are, of course, not confined to motor drives, being ideally suited to any of the established prime movers. While main drives from electric motors to lineshafts or machines are probably the most familiar applications for chain transmission, numerous secondary motion drives employ chain advantageously.

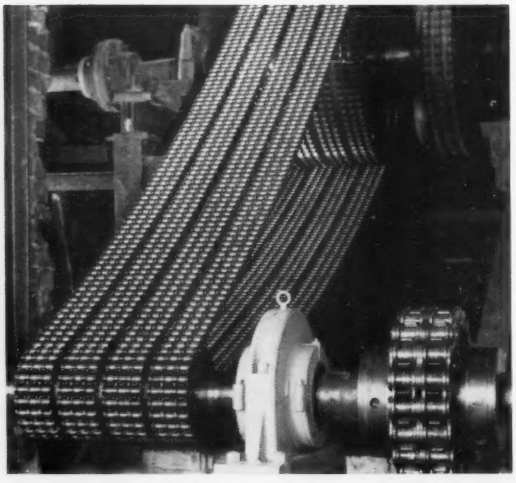
The next two pages picture eight typical examples of roller chain application. The diversity of application should provide some clues for other practical uses for chains. The illustrations used throughout this article show Renold roller chains and have been provided to Design Engineering by Renold Chains Canada Ltd. ★



A 750-rpm motor developing 650 hp drives a compressor in a coal mine. Compressor speed is around 5000 rpm. As speeds of this magnitude are approached, smaller pitch chains and multi-strand drives are used to increase the drive capacity.

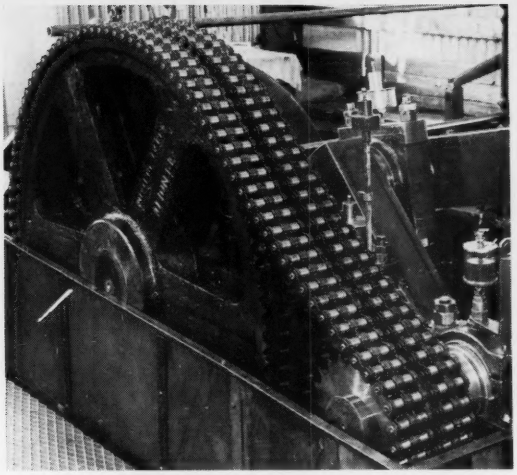


Here's an example of a medium to high speed drive that provides the power for a water pump in a generating station. The pump is driven at 2050 rpm with a triple, three strand roller chain.

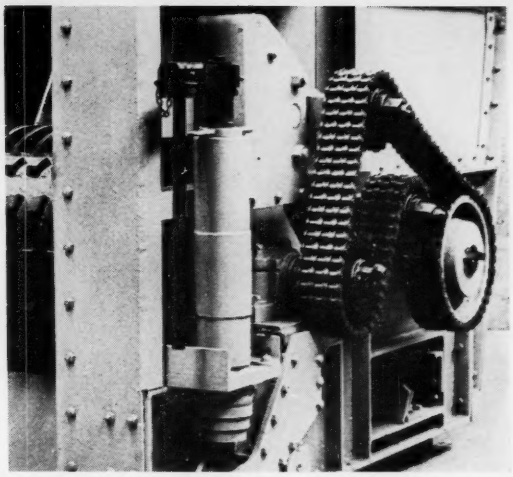


This chain drive handles the lineshaft of a paper making installation comprising a 65-cylinder paper-making machine, two sets of calenders, a sheet cutter and a reel drum. Two motors are used to provide alternative speeds, from 115 rpm to 1150 rpm.

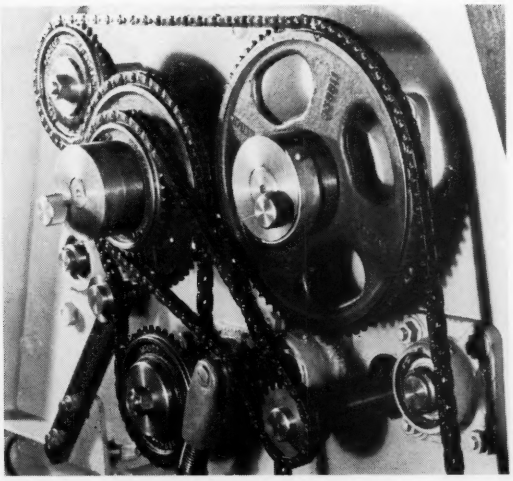
The primary drive from a water wheel powering a grain mill. Chain is 2.50 pitch, triplex. Provides 50 hp at water wheel speed of 8 rpm and mill speed 25 rpm.



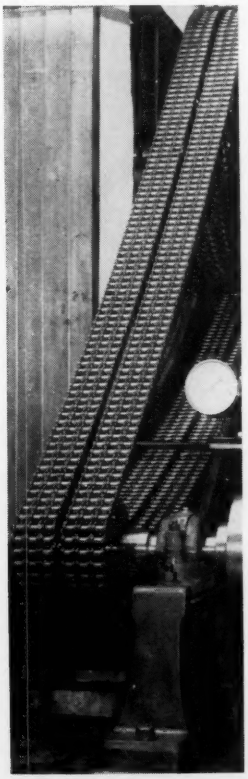
The compactness of a chain drive is well illustrated by this installation of the second stage drive to a three cylinder reciprocating water pump. The chain was designed as a replacement for a direct gear-to-gear drive.



Another compact drive is that to the rollers of a two roll grizzly for crushing stone or coal. This is an operation giving rise to highly impulsive loading in the drive, and special thought must be paid to the resilience.



And here's something that contrasts to the heavy drives shown. This is a compact series of drives to the multiple motions of a thermo-plastic coating machine. The flexibility of chain to gear on the reverse side is fully exploited here.



After 21 years of operation, this drive is still very little worn. A 300-hp unit from a water turbine it illustrates the value of proper installation.

Which would you choose . . .
. . . V-belt or flat belt?

Suppose you had to make the choice right now . . . which would it be? What factors would you consider? What are the advantages and disadvantages of both types? We invited a proponent for each type to present their respective cases. Here is what they have to say.

The case for V-belt drives

George C. Fair *Gates Rubber of Canada Limited*

Modern industry drives more equipment through the medium of V-belts than any other single form of mechanical power transmission. Recent studies indicate that approximately 65% of all drives used in industry today are V-belt drives. There are obviously strong arguments in favor of V-belts as the most totally desirable driving medium, else these results would not exist.

It is axiomatic that anyone responsible for the selection of driving media, whether it be V-belts, chain, gears, flat belts or any other form of mechanical power transmission, should be equipped with all the pertinent factors necessary for making a sound decision. Otherwise the selection must be a matter of guesswork, and this is certainly not the mark of a good design engineer.

The one basic principle to be observed in determining the best method of power transmission is to decide "which medium provides the most efficient, trouble-free service at the lowest possible cost per unit time." The time element implied is generally an annual basis, though it could be seasonal or any other predetermined period depending on the economic utilization of the equipment involved.

Too frequently a form of power transmission is selected that appears to be the best, but in effect is actually a matter of initial convenience only, and could possibly prove to be the most costly over the longer period of time. All forms of power transmission have an ideal area in terms of speed, load, space required, nature of the drive and driven units, and so on. These qualify the choice as the best to use under the circumstances and in light of the economics involved.

Factors to consider

One of the accompanying tables lists those features that are most often considered when designing a driving arrangement. Included also is a suggested method of scoring the various media of mechanical power transmission, thus indicating the degree to which each media meets the requirement. The suggested method is the scoring of either 0, 5, or 10, denoting that the media has the feature to an insignificant degree, to a moderate degree or to a very significant degree. For example, the feature of positiveness is scored more heavily in favor of gears, chains and direct drives than for either V-belts or flat belts. The reasons for such scoring are obvious. Also under sound level, most gear and chain drives give off considerably more noise than belts. The scores indicated are those ascribed by the author. We recommend that you make up your own scoresheet and find out exactly how you would rate the different drives.

The new V-belt

With the development of new materials, whether they be metals, plastics, or synthetic fibres, all modes of power transmission are vastly improved over what was available prior to, or shortly after the last war. Because of these developments in materials, the modern day V-belt is vastly superior to its predecessor. It can now be used in areas which were formerly impossible.

Gates Rubber of Canada Ltd. markets their new belts under the tradename of Super HC, while other manufacturers have their own chosen names.

Because the new belts can be operated over pulleys of smaller diameter than were possible with the old belts, higher speed ratios can be designed into today's installations, and the drives can be made more compact. In most instances, these factors will combine to make an over-all drive less expensive. In addition, the new belts have a very high resilience to shock loads.

Too frequently one feels that improvement in a given product should be reflected in added life. In the competitive environment in which manufacturers operate today (and not only the manufacturers of power transmission equipment) it is important to carry out design based on the probable life of the unit. The only time when added life should be built into components is when the alternative components are inadequate to satisfy the projected economic life of the product in question. It must be recognized therefore that most improvements in the field of power transmission have been designed to bring about savings in areas such as space, cost, improved performance or greater capacity rather than in length of life. Thus the new super belts, when designed into a unit in accordance with the published data for them, have life expectancy of 25,000 hours, exactly the same as for the conventional cross section belts.

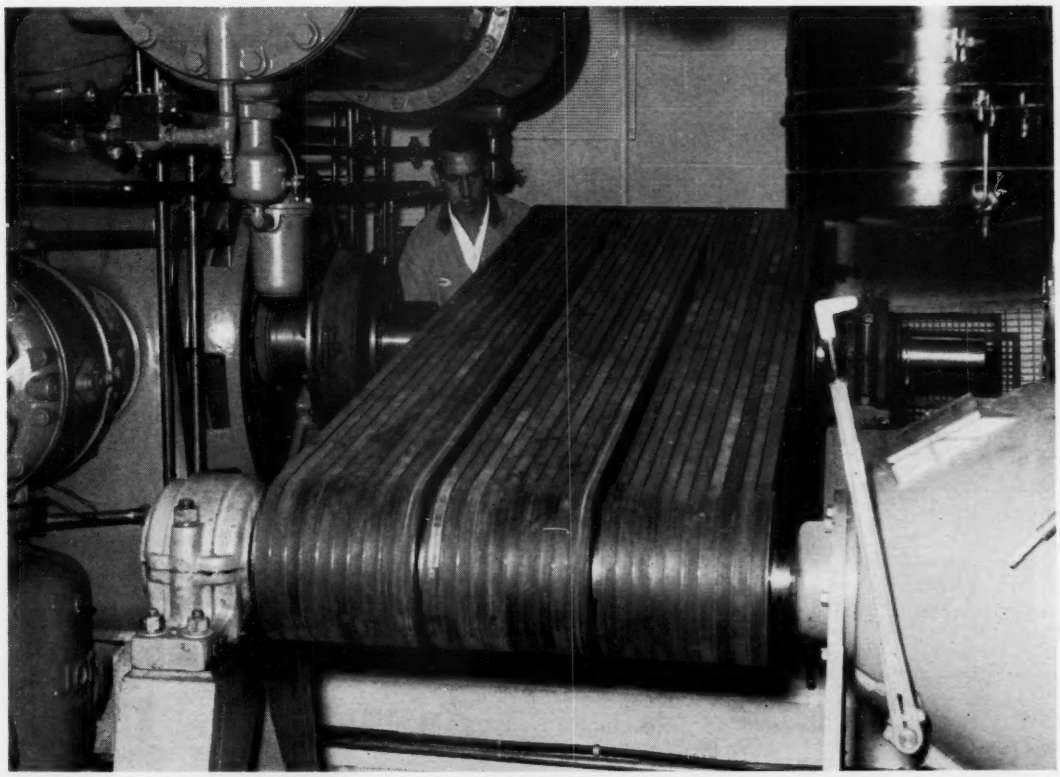
Design for service

Reference to a standard V-belt design procedure whether it be the new belts or the conventional cross section ones, will indicate that for slow speeds, say up

A rating chart for different drives

Feature	V-belt	Flat belt	Gears	Chain	Direct drive
Positive drive	5	0	10	10	10
Compactness	10	0	10	10	10
Easy on bearings ..	10	5	5	10	10
Dependable	10	0	10	0	0
Quiet	10	5	0	0	10
Clean	10	10	0	0	10
Shock absorbing ..	10	10	0	5	5
Changing	10	10	0	5	0
Installing	10	10	0	5	5
Maintenance	10	5	0	5	10
TOTAL	95	55	35	50	70

Here's how the author rated the different drives . . . how would you score them?



Compressor drive at Garrett Manufacturing required more than the usual design considerations to get optimum service from equipment (see page 48).

to 1,000 feet per minute, V-belts should not be used. This is a most common misunderstanding, as many of you readers will probably be able to affirm. V-belts can be used in these speed areas, but it is possible that alternative types of drives may be desirable.

It cannot be pointed out too strongly that the greatest need in the selection of a driving medium is good engineering judgment. The correct answers are not always readily determined solely on the basis of recommended design procedures. Take for example, the problem of a compressor drive at Garrett Manufacturing Ltd. in Rexdale, Ontario. A compressor drive was required with load in the order of 600 hp, as would apply to a testing arrangement for aircraft components. Original examination of the problem indicated that V-belts would not be adequate for the job.

However, after examining the cyclic load conditions, estimating the economic utilization of the equipment, checking out bearing loads, etc., a V-belt drive was designed which at first glance would appear to be most inadequate. The drive capacity of the unit chosen was somewhat less than 300 hp, based on a 25,000-hour life expectancy. But the whole unit was never expected to last this long. Through proper interpretation of the stress-fatigue curve for the belts involved, a prediction of the life expectancy for the belts, under the loads to be encountered, more than met the projected utilization of the equipment. The resultant cost of the V-belt drive was considerably less than the cost of other proposed forms of power transmission.

V-belts like any other form of power transmission, can be mis-applied. They will perform at the lowest speeds where gears and chains are usually found, as well as at the high speeds usually reserved for other drives. In each of these areas of speed, as well as load, special consideration must be given to bearings, tensioning, take-up and so on.

Irrespective of the nature of your power transmission needs, we recommend that you consult qualified power transmission specialists as the best possible source of guidance in providing the medium giving the longest trouble-free service at the lowest possible cost. ★

The case for flat belt drives

James J. Ross *Extremultus Transmissions Limited*

In this day and age new inventions and innovations come upon us so fast that there is not always time for us to absorb the significance or importance of something that could radically change our thinking on matters which appear commonplace. Thus, to most design engineers the thought of specially designing a modern drive to suit the peculiarities of a flat belt would be akin to designing a modern vehicle to run on solid tires.

Yet within the space of the past three years in Canada and elsewhere, design engineers have been specifying new equipment to be driven by a flat belt in preference to other methods.

These belts are not the old-fashioned plain leather or fabric web types. They have been born of modern technology . . . for modern applications. They are made by bonding two outer layers of chrome leather to a polymer core. Pioneers in this field were the German firm of Sieglingriemen, who registered their nylon-cored product under the name of Extremultus. Shortly after the end of World War 2 manufacture of this belting began in Britain and is marketed under the trade name Miraclo. In Canada, in deference to its dual origin, it is known as Miraclo-Extremultus and one Canadian engineer has suggested that this new belting has "revolutionized the science of mechanical driving." All the data on flat belting given in the following paragraphs are based on results obtained with this nylon-cored product. It should be mentioned that other polymers are used by other manufacturers, but these impart somewhat different characteristics to the belting.

What are its characteristics?

Engineers have always had very definite basic requirements for the ideal transmission belt. Four of these characteristics, and the statistics on the new type belting we are discussing here, are:

1. **High load carrying capacity.** The highly oriented nylon type polymer has a tensile strength which approaches the strength of mild steel — 28,500 psi. This is from 5 to 10 times greater than that of leather belting. The only type of belting that might exceed this load carrying capacity is one with a steel cable. However, a belt with steel cable must sacrifice one of the other ideal characteristics — elasticity.

2. **Elasticity.** This is required in a power transmission belt to absorb shock loads and to enable the transmission of power without vibration. The modulus of elasticity of the nylon core is 85,000 psi but what is more important is that the yield point is almost identical to the ultimate tensile strength. Thus the belt is perfectly elastic and will not take on permanent stretch or deformation under shock load conditions.

3. **Flexibility.** No belt can claim perfect flexibility and in bending around a pulley some work is done in overcoming internal friction. The operating life of a belt is affected to the greatest extent by this one factor. Because of its ability to transmit a given load with a much thinner more flexible tensile member nylon cored flat belting is considered ideal.

4. **Coefficient of friction.** The special chrome tanned leather used has a coefficient of friction of 0.8, which is 2 to 3 times that of all other belting materials. The reason for this lies in the fact that the leather used is tanned for coefficient of friction properties and not to provide for strength or load carrying properties. The load is carried by the core.

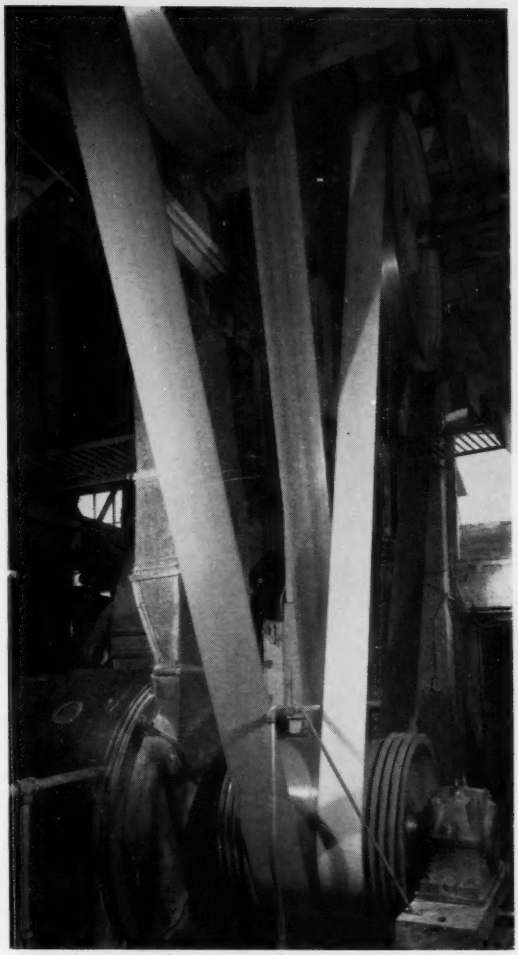
What about belt speeds?

Belt speeds are limited in all drives by the tendency of centrifugal force to throw the belt away from the pulley. This tendency in conventional V-belts prohibits belt speeds in excess of around 6,000 feet per minute. Actually, the recommended speeds for V-belts are 4,000 to 5,000 feet per minute. Even at these speeds a major portion of their total tensile strength is used up just to hold the belt down on the pulley.

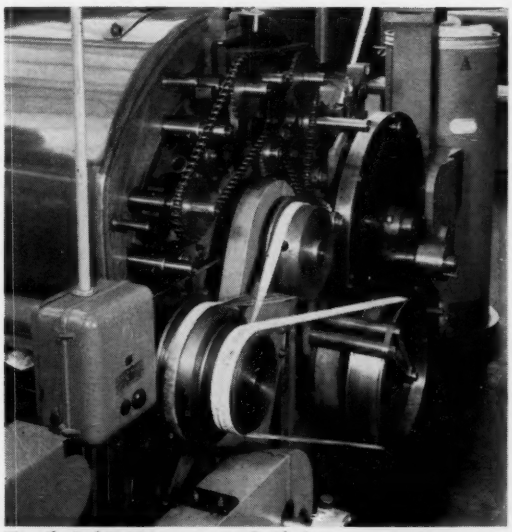
Polymer cored flat belting, because of its low weight to strength ratio, is commonly used at speeds up to 10,000 feet per minute. In fact, it has been successfully operated at 25,000 feet per minute on a machine which centrifugally tests material to destruction. The horsepower capacity per inch of width for nylon cored belting reaches its peak around 12,000 feet per minute.

Section	Horse Power	Inches Width Leather	Inches Width Extremultus
Couch	90	14	4
First press	35	8	1½
Second press ...	35	8	1½
Smoothing press .	17	6	1
1st dryer section	47	10	1½
Breaker stack ...	17	6	1
2nd dryer section	22	10	1
Size press	17	6	1
3rd dryer section	18	8	1
Calender stack ..	79	12	3
Reel	15	6	1

Comparison of regular leather belting with nylon polymer cored belting on cone pulley paper-machine drive.



A 250 hp motor drive at speed of 3660 feet per minute uses 7 and 9 inch wide belts.



Textile industry uses many flat belt drives . . . here's compact arrangement on cotton card.

In the papermaking industry these high speed characteristics have enabled design engineers to design and build mechanical lineshaft drives capable of driving a paper machine at speeds in excess of 2,000 feet per minute whereas previously the maximum speeds used to have been limited to around one half that figure. Another important factor is that by using polymer cored flat belting it has been possible to drastically reduce the width of belt. On a cone pulley drive this permits much finer adjustments and where several sections are involved, such as on a paper machine lineshaft drive, it is easier to adjust the draws between sections, thus reducing paper breaks with consequent downtime and loss of production.

Some design considerations

What are some of the factors you must consider with every mechanical drive design you undertake? What are the practical operating considerations you must remember to apply? Let's discuss some of these.

- **Maintenance** — The necessity for belt take-up or shortening is virtually eliminated. Because nylon cored belting will not take up a permanent stretch it can be run on fixed centres without any means of take-up. The belt will maintain the tension at which it was installed.
- **Bearing loads** — It is obvious that these should be kept to a minimum. Lower loads contribute to longer life and lowered maintenance. Because flat belting of this type has a very high coefficient of friction, as indicated previously, the total that must be used to transmit any load is kept to a minimum. In addition, the shock absorbing capacity of the belting insulates the bearings from shock loads.
- **Belt life** — One of the major causes of deterioration of belting is the slippage that takes place between the belt and its contact surfaces. Because of the relatively high coefficient of friction slippage is minimized, with a resultant extension of belt life.
- **Drive performance** — Positive transmission of power assures instant start-up without slip, even where starting torques are high. Drives using nylon cored flat belting have proved themselves more than 95% efficient.

Typical installations

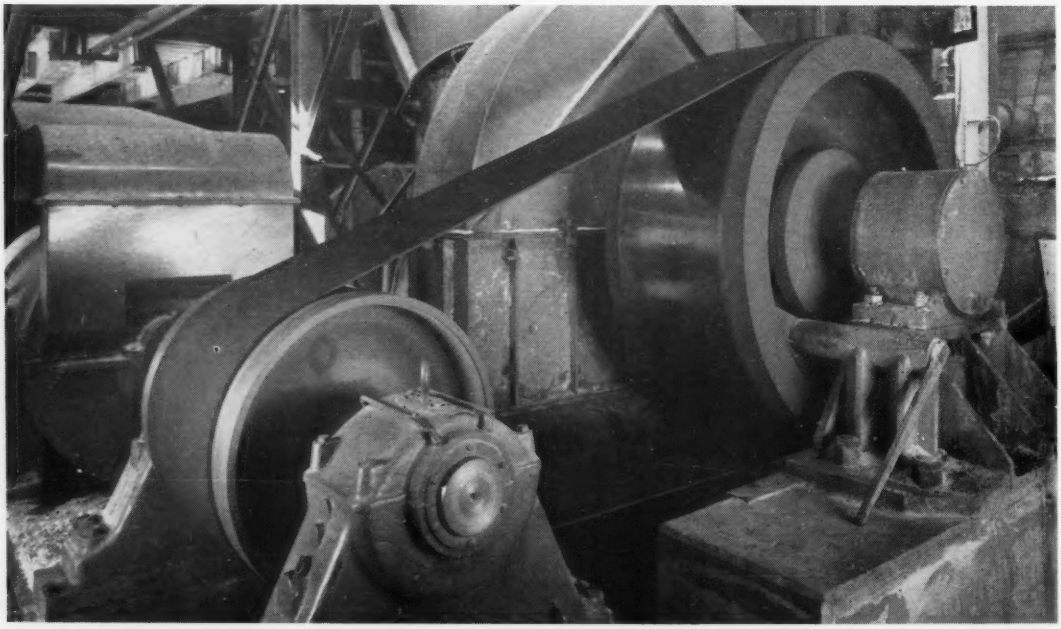
Although, as we have stated earlier, this type of belting has been available in Canada for only three years, it has been applied in most of the areas of industrial production in this country.

In the papermaking industry it has been used extensively on existing cone pulley drives where it has been desired to up the production speed. Also, several new lineshaft drives have been designed and built for Canadian mills with this type of flat belting specified.

One application that is particularly interesting concerns the drive on wood chippers used to convert logs into chips for pulp making. Due to the variance in the sizes of the logs and the rate at which they enter the chipper, high peak surges of power are experienced, ranging up to 250% of the rated capacity of the drive motor. Illustration below shows the 600 hp chipper installation at a Quebec mill having an overload of 1,500 hp. The belt used is 22 inches in width.

One of the major problems in the textile business is to maintain constant spindle speeds on such machines as twisters, even though the spindle has only minimum contact with the drive belt. The belt pressure against the spindle is the important factor here, as too high pressure causes bearings to wear prematurely. Spindle pressures were backed off to one fifth of their former pressure when nylon cored belting was adopted in one installation.

The lumber industry has a reputation of being very hard on belt drives. Perhaps their most ardous drive is provided by the gang saw. Service conditions are extremely rugged and operation is often on a 16-hour-day basis. Severe oil and water conditions may be encountered. Continuous shock loads are also evident. Many manufacturers of gang saws now specify nylon cored flat belts as standard on their equipment, and many such units are in use in Western Canada. ★



Wood chipper in Canadian mill converts logs into chips for pulp making. This 600 hp unit has an overload capacity of 1500 hp.

There's really no trick to it—you simply need the facts

Here's the inside dope on the selection and application of heavy duty radial type precision roller bearings

R. E. Leeming, P.Eng.
Fischer Bearings Manufacturing Limited

Workman makes final check of i.d. before shipment of typical heavy duty bearing.

The term "heavy duty bearing" is commonly used to indicate bearing applications which are vital for the maintenance of production runs in heavy industries involving rolling type applications, as for example, in steel or paper mills. In such applications the life of the bearings employed is of extreme importance and must be carefully appraised in the original design of the equipment.

"Heavy duty bearing" is also a general trade name often adopted to indicate a bearing application where the ratio of the prevailing load to the capacity of the bearing is intermittently high. To the bearing technician, this is generally expressed as $\frac{P}{C} > 0.15$, where P is the equivalent radial load and C is the basic load rating, calculated from the size and number of rolling elements. It is often the frequency and magnitude of shock loading which increases the equivalent radial load acting on the bearings, such as occurs in forges, steel mills, earth-moving equipment, shaker screens and crushers.

Many different factors must be considered in evaluating each bearing application, as outlined on page 53 in this article. However, their individual importance varies with each application. Once the conditions are completely analyzed, the type and size of bearing may be readily chosen from reference tables and manufacturers' data.

Most of the factors can usually be determined and analyzed from drawings and specifications. There are times however, when the bearing engineer should inspect the application site to make certain that the conditions for handling, installing and maintaining the bearing are adequate.

The basic load rating for radial type roller bearings is calculated by using this formula:

$$C = f_c\,(i\,l_{eff}\cos\alpha)^{7/9}\,Z^{3/4}\,D^{29/27}$$

where:

- C = basic load rating
- f_c = a factor, depending on the units used, geometry of the bearing components, accuracy to which parts are made, and the material used
- i = number of rows of rollers in one bearing
- l_{eff} = effective length of contact between one roller and that ring where the contact is the least
- α = nominal contact angle — the angle between the line of action of the roller load and a plane perpendicular to the bearing axis (for cylindrical bearings = 0°)
- Z = number of rollers per row
- D = roller diameter (mean diameter for taper rollers)

(From AFBMA Standards, section 11, 150 TC4 recommendation No. 278)

Basic types of available radial roller bearings

There are four major types of bearing available in the classification of heavy duty bearings. These are: cylindrical roller bearings, single row spherical roller

bearings, double row self-aligning roller bearings and taper roller bearings.

The double row self-aligning roller bearing has become the commonly accepted standard for many of the so-called heavy duty applications, primarily due to its capacity to absorb punishing radial and thrust loading. It is often also chosen to act as a safety precaution in accommodating comparatively high misalignment. Some applications necessarily require the use of self-aligning bearing because their degree of misalignment is so excessive as to preclude the use of other types of roller bearings.

However finer degrees of alignment are not only becoming more common nowadays but are becoming mandatory in some machine application, such as in sheet type rolling equipment for the fabrication of paper and sheet metals. **Here the degree of alignment does not exceed that which can be adequately accommodated by taper or cylindrical roller bearings.** These alternative types of bearings also provide rigid guidance of the material being processed and are separable type bearings, which simplifies installation and assembly.

Taper roller bearings can be adjusted to required operating internal clearance by the application of a precise amount of axial loading. Little or no interference is employed between the bearing and rotating shaft or housing.

All other forms of roller bearings depend on an expansion of the inner ring, or contraction of the outer ring, during assembly and operation to obtain the required operating clearance. For heavy duty applications, however, an interference fit should always be employed.

Taper and cylindrical bearings are also available with rings manufactured to finer tolerances for higher speed applications. In applications involving shock loads and shaft misalignment, but where axial loads are negligible, consideration should be given to employing the narrower and more economical single row spherical rather than the double row variety.

The fit is important

Generally, roller bearings are delivered with larger radial clearance than are required when the bearing is in operation. Interference fits between the bearing rings and mating parts (shafts, housings, sleeve) cause the inner ring to expand and the outer ring to contract. The amount of interference is therefore extremely important if the optimum carrying capacity of the bearing is to be realized.

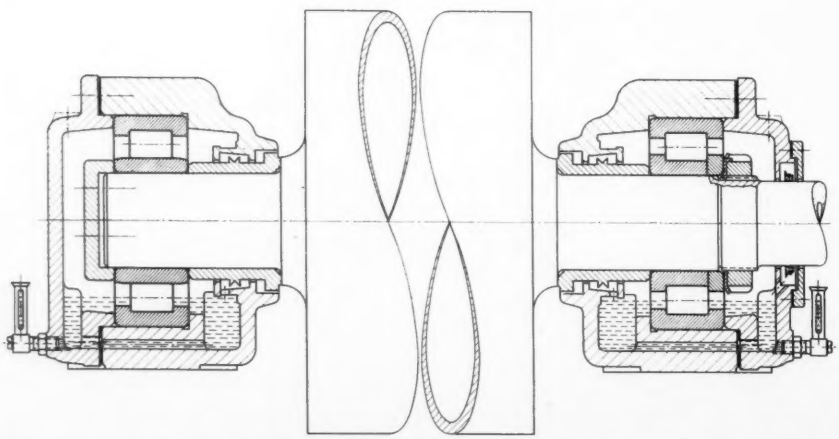
Bearing rings are relatively thin sectioned so that flexural stresses or early fatigue will occur if the rings are not sufficiently mated. Conversely, excessive fits cause insufficient radial clearance or even preloading, which results in hotter running, noise and possible premature failure.

The amount of interference between the mating parts is primarily dependent upon the magnitude of the applied load. Shock loads in particular can momentarily loosen a bearing ring, and when this action is repeated, promote slippage and wear. Other factors determining the fit are: the bearing ring cross-sections relative to their diameters, the degree of roughness between the mating parts, coefficients of expansion when dissimilar materials are mated, and of course, the required internal clearance of the bearings when operating.

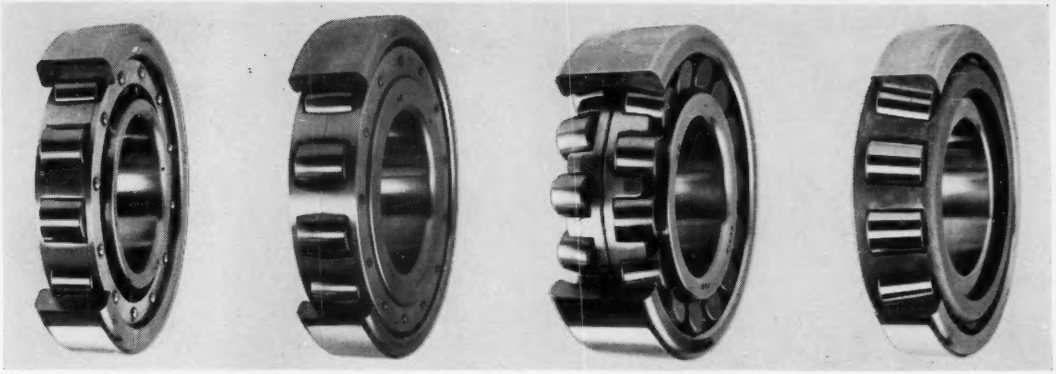
When mated, the roller bearing must maintain its true cylindrical or conical form as accurately as possible. Deviations of the seating surfaces from the specified limits of roundness or taper will be transferred to the bearing. This will result in cyclic peak stresses, and it can be shown that **the rated bearing life varies inversely as the ninth power of the stress!**

Thus the necessity for maintaining finely ground or polished seating surfaces for bearings becomes increasingly important at higher operating loads and speeds. Tapered sleeves with finely ground conical mating surfaces are often employed to offset the lack of finely finished seating surfaces if these cannot be feasibly provided on the shaft. Shafts or journals are also sometimes provided with tapered bearing support surfaces on which the bearing bore is directly mated. Cylindrical mating surfaces on a journal usually can be more feasibly finished than conical surfaces.

Various methods are used for assembling heavy duty bearings. These include heated oil baths, refrigeration, induction heating, hydraulic forces. Separable type bearings are more simply assembled than non-separable type bearings, since the rings to be mated are first fitted on the shaft or in the housing and then combined in place on the journal. The ring to be fitted depends upon which ring is actually rotating.



Dryer roll with two cylindrical roller bearings. Adapter and sleeve mounting also possible.



Here are the four types of heavy duty bearings . . . from left to right . . . cylindrical, single row spherical, double row self aligning, taper roller.

Here are the seven factors on which to base your selection

Here are the operating conditions which must be completely assessed before a bearing can be selected.

- **Type and magnitude of loading:** The external loads must be analyzed and broken down into axial and radial components — factors must be introduced to compensate for such items as the types of belts or gears, shock, or type of road or rail.
- **Operating speed:** Speeds are usually expressed as the shaft rpm except where inner ring is fixed and outer ring rotates. The life of a bearing theoretically varies inversely as its operating speed, but the limiting speed of a bearing can be increased by such devices as decreasing the runout of the rings, reducing the weight of the cage, varying the form of lubrication or guiding the cage on fixed shoulders.
- **Operating temperature:** Generated bearing heat and ambient heat affect the thermal gradient through the bearing. Generally the inner ring runs hotter than the outer ring. Therefore, the operating temperature largely defines the internal clearances to be designed into the bearing.

The boiling point of water is often employed as a rule of thumb to define the upper temperature limit at which standard precision bearings may operate without reducing the hardness of the rolling elements and rings. Temperatures in excess of this result in a corresponding decrease in the basic load rating of the bearing. For short periods of operation the bearing may be permitted to reach a temperature up to 230F. For still higher temperatures (as in paper machine dryer rolls) bearings with special heat treatment can be procured.

The operating temperature also determines the amount of thermal expansion of the bearing parts and adjacent parts. For example, the lineal expansion of a shaft must be accommodated at the float end of the bearing. Thermal expansion may also result in a lessening of the degree of interference between the bearing ring and its mated shaft or housing. This must be considered in determining the integral operating clearance of the bearing itself.

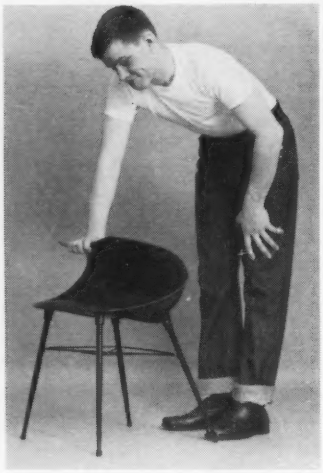
- **Alignment characteristics:** While reasonable care should be given to the design of every machine to ensure easy alignment, some shaft deflection and uncontrollable misalignment must be expected in most applications. Bearings must be employed which will adequately accommodate the degree of misalignment while simultaneously providing sufficient load carrying capacity and guidance for the mated parts.
- **Installation and disassembly:** Space restrictions often limit the type of bearing which must be employed. Care must be taken in the original design of a machine that bearings of sufficient capacity and possessing the required attributes may be incorporated.

Likewise, means must be provided to ensure that the bearing may be readily disassembled or removed for maintenance purposes, inspection or replacement. This is especially true in those designs where the bearing rings are mated with an interference fit, so that heavy withdrawal forces are not necessary.

- **Sealing:** For larger bearing applications effective means of keeping lubricant in the bearing and keeping dirt out are tasks more generally assigned to the housing and seal arrangement. Some bearings, of course, are manufactured with shields as an integral part of the bearing ring. Care must be taken in the design of the housing that the arrangement is not so overly simplified on the basis of economics that the adequacy of the sealing system is jeopardized. A system of grease filled labyrinth chambers and slingers is often employed. Contact seals of neoprene or felt are also commonly used, either singly or in combination with the labyrinth network.
- **Lubrication:** This is a special subject unto itself, and many books and articles have been written about it. The important thing to remember is that the bearing must be adequately lubricated at all times, but never over-lubricated.

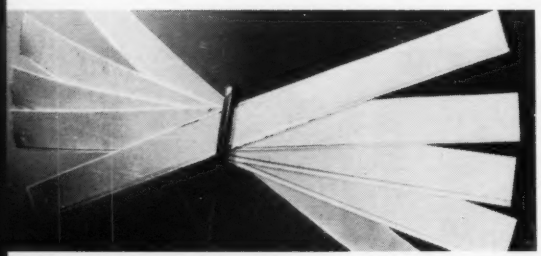
The housing design for oil systems should include return channels to ensure that the oil is not trapped in the housing chambers. External visual oil gauges must be provided for oil pump systems, and oil level should be maintained to a depth of one-half the height of the lowest rolling element.

Designews in pictures

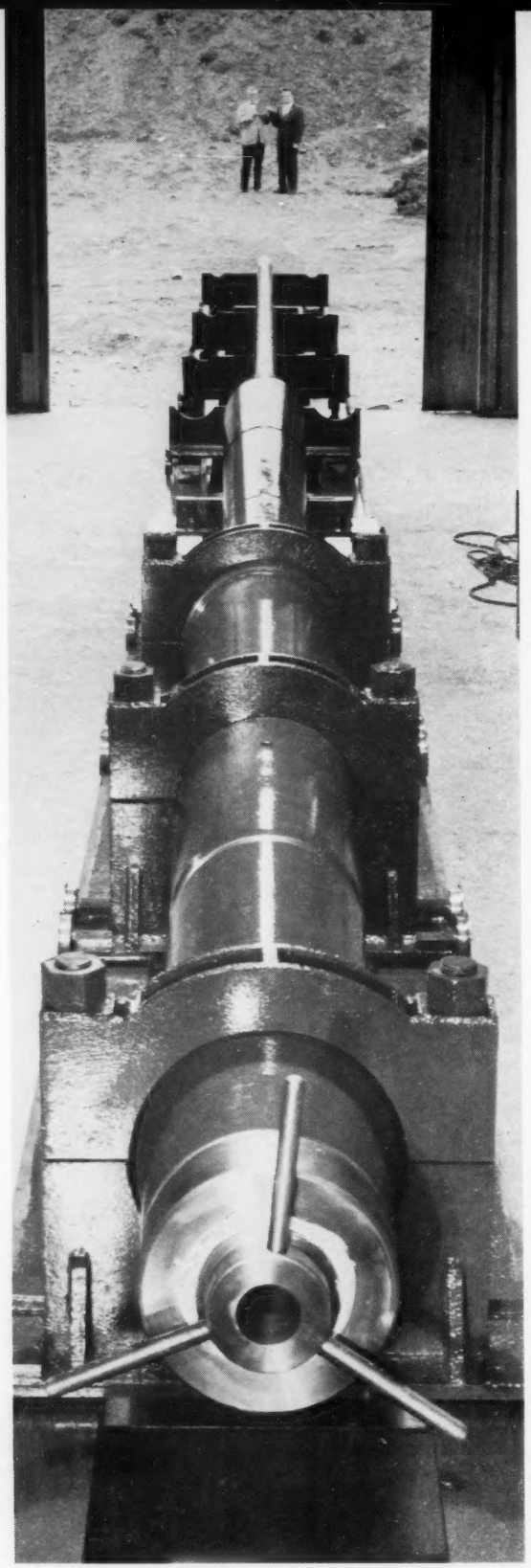


Flexing action of durable polypropylene gives a yielding "form fit" chair.

Still another easily washable British lamp design in spun cellulose acetate.

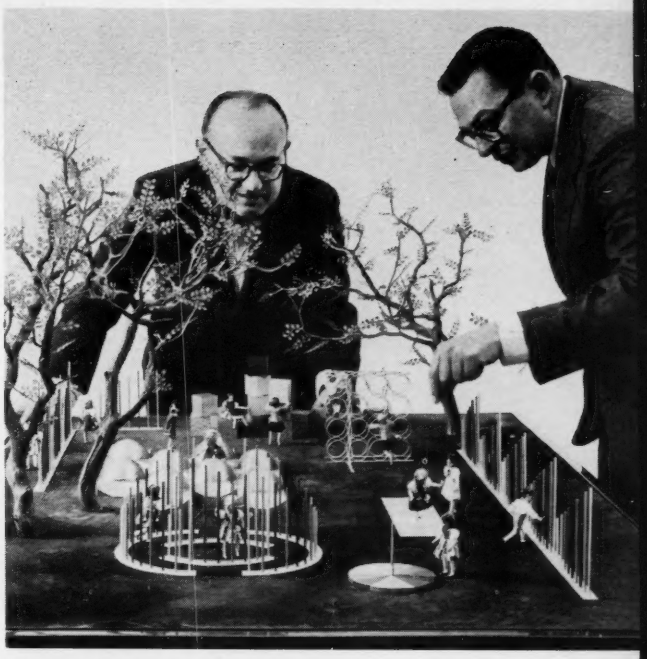


Strips of new, thinner tin plate are threaded five at a time through needle's eye.

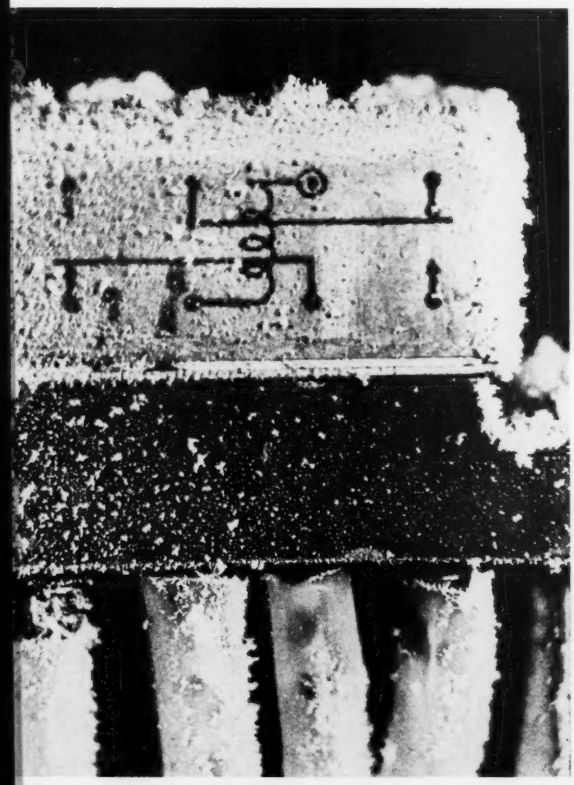


Double chamber light gas gun at North America's first privately owned aerophysics laboratory, Stittsville, Ont.

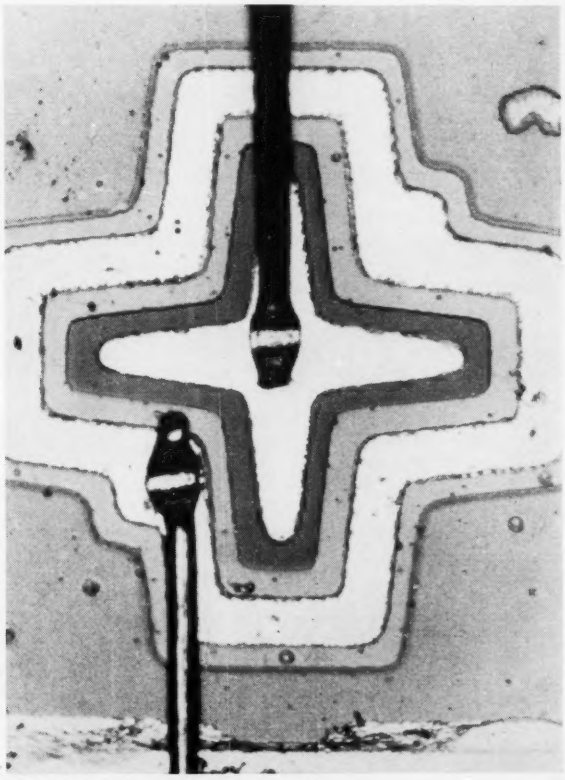
World's first solar powered car was at the disposal of important guests at Canada's IRE Show in Toronto.



Playground, even down to the trees, is modelled entirely from aluminum to demonstrate metal's design potential.



Half-size crystal-can relay subjected to cold likely to be encountered in space ride through earth's shadow.



Star geometry of new silicon epitaxial planar transistor is credited with improving frequency response.

70 ways to lock a screw fastener

Reusable using standard parts

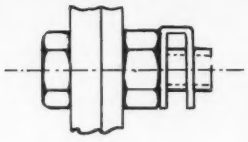
A compendium of ideas to help you solve a repeating problem

When a screw-nut assembly works under constant load, the self-locking feature of the standard thread is usually sufficient to prevent unwanted loosening. However, there are many cases of machinery, tools, instruments, or other equipment which work in such a way that the fastening arrangements are subject to oscillating loads, shock, impact, vibration, and other forces tending to counteract the self-locking action of the threads. In these cases the screws and nuts must be safely secured against accidental, unwanted loosening.

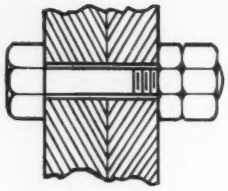
There are a number of ways in which this problem may be solved. The selection of the right method often presents a dilemma to the designer, for it must be selected empirically based upon personal judgment and experience.

The governing principles are chiefly the magnitude and characteristic of the loads, and the properties of the materials employed in the assembly components. Many of the methods used may be applied after the design has been completed (or even after the equipment has been in use for some time) but some of the arrangements must be incorporated during the design stage.

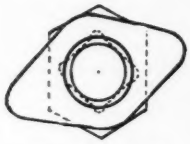
There are many industrial products (both patented and otherwise) on the market today which afford varying degrees of locking for screw-nut arrangements. Full data on these can be obtained from the manufacturers' catalogues. However, there are many alternatives to these special store-bought products — the accompanying sketches show some that the author has encountered. ★



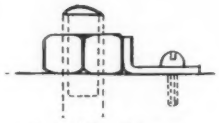
Elastic clip on protruding free end of the bolt.



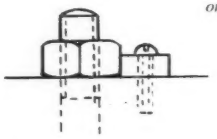
Jam or lock nut between regular nut and body of work.



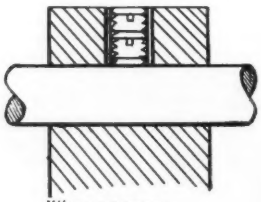
Locking nut without threads made from thin sheet steel.



Vertical leg of square piece leans against one nut-face.

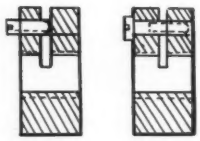


Flat steel piece located so as to prevent nut turning.

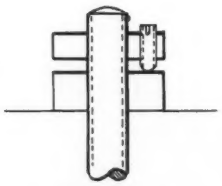


Where set-screws must be locked you can use two short ones.

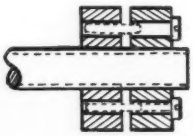
When bolt end is flush with nut, put set-screw between.



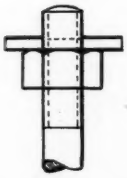
Make radial slot in nut and use set-screw to open or close.



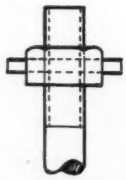
Metal stamping permits axial pressure with set-screw.



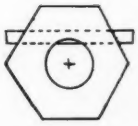
Supplementary nut stays parallel by using two set-screws.



Tightly fitting round pin inserted in drilled hole.

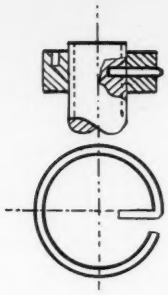


Hole for round pin can go through both nut and bolt.

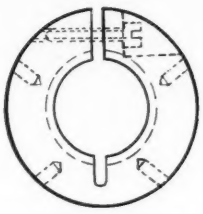


Hole tangential to bolt threads will hold nut very tightly.

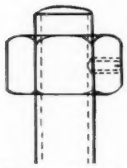
Reusable using special parts



Wire through hole and twisted around nut will also hold.

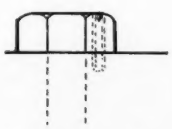


Radially split nut locked with small screw after tightening.

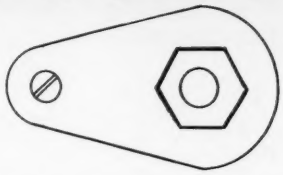


The standard set-screw method with point in spot-drilled hole.

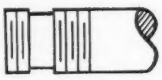
Set-screw goes through nut and bites into main workpiece.



Set-screw through bolt-head . . . no nut is required.

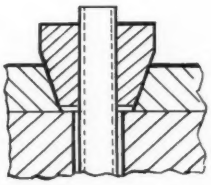


Large stop plate contacts all six sides of the bolt head.

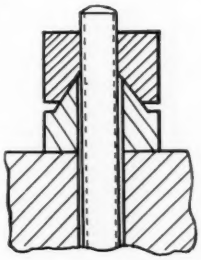


Filing away part of the threads will hold bolt in place.

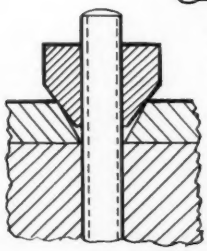
Hole and slots in end of bolt . . . tapered pin does the rest.



Hex nut tapered on bottom half matches conical hole.

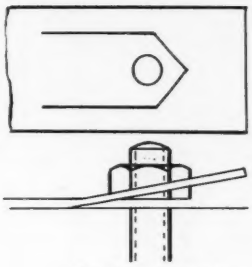


Two nuts with matching tapers create tight fit on bolt.

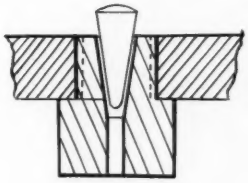


Making the female taper slightly less than the male taper.

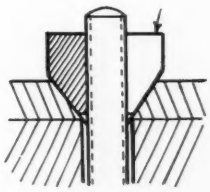
Plate from thick flat steel contacts four sides of the nut.



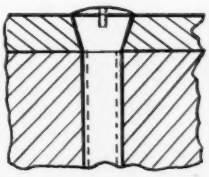
Rectangular stop plate with slit which is bent up to make contact.



Tightly fitting tapered pin fits in hole in the bolt

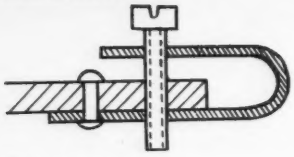


Slotting the nut helps improve the fastening qualities.

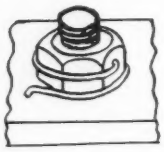


Countersunk head machine-screw with 60 degree angle taper.

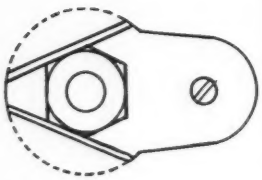
reusable using special parts continued



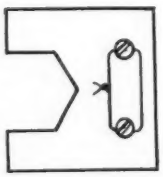
Pre-loaded flat spring clip acts on its own.



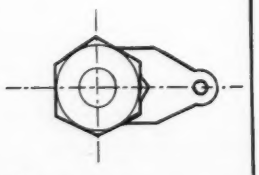
Steel wire inserted in hole in side of nut before tightening.



Two tabs on stop-plate stop nut from turning as required.

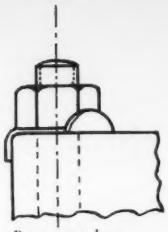


Stop-plate is held in place by two screws with wire retainers.

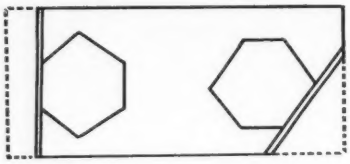


Extra cuts on stop-plate permit extra working positions.

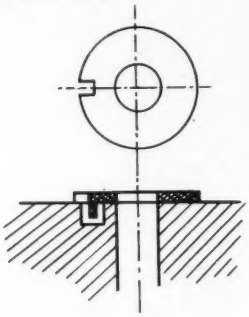
Permanent



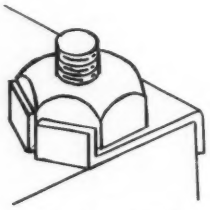
Bent up tab on circular washer bears against nut face.



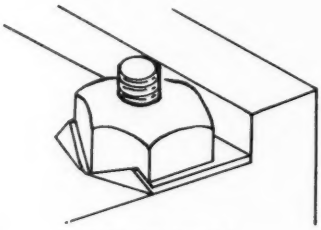
Bent up tabs on long plate holds two bolts in place.



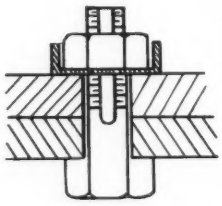
Bent down lug fits in hole drilled in the workpiece.



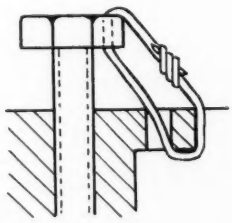
Corners of rectangular stop-plate are bent up to make contact.



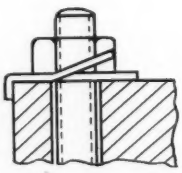
Another way to make use of bending washer against nut.



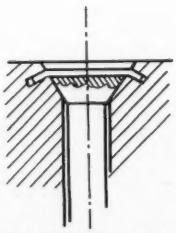
Lugs on circular washer are bent up after fastening.



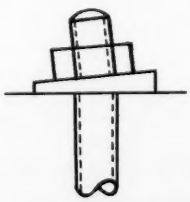
Wire through hole in bolt head and workpiece does jab.



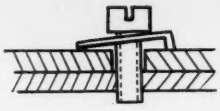
Split tab is deformed after tightening to make sure locking.



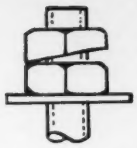
Flat head screw held in place with short piece of wire.



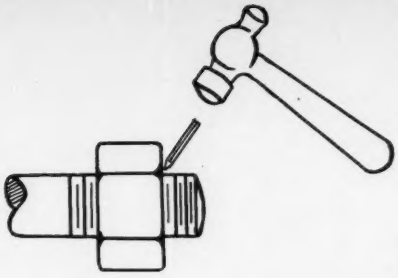
Wedge-shaped washer tends to bend free end of bolt.



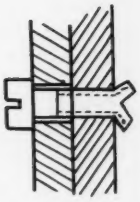
Bent washer is another simple device for boltheads.



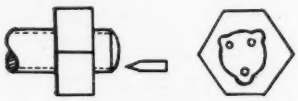
Separate lock nut is tapered on one side.



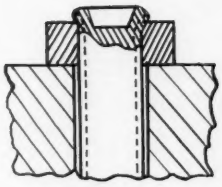
This is the simplest method with which we are all familiar.



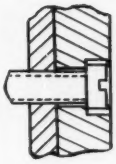
Protruding end of bolt is deformed with punch.



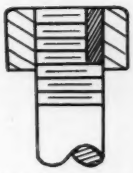
Prick punch or nail set used to deform end of bolt.



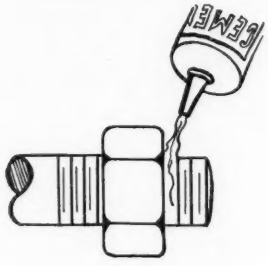
Shallow depression is cut in bolt end before deforming.



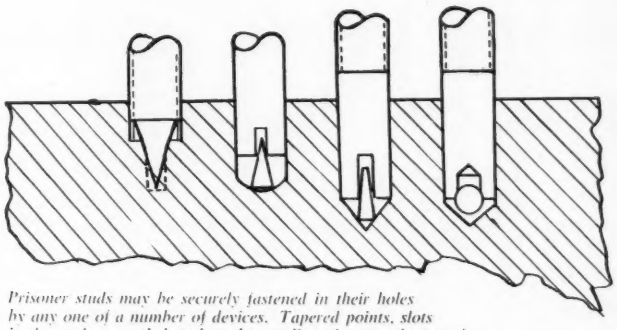
Solder or welding are two other tried and true methods.



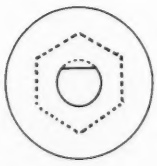
Hole between nut and bolt may be filled with cement or solder.



And who hasn't heard of using some form of cement or shellac?

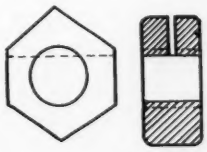


Prisoner studs may be securely fastened in their holes by any one of a number of devices. Tapered points, slots in the stud, tapered threads and spreading pins are often used.

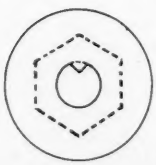


Milled longitudinal flat on threads matches nose on washer.

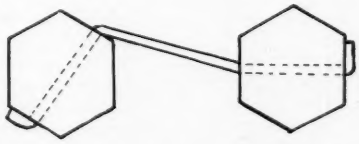
Wire passed through holes drilled in bolt heads.



Slot in nut is closed by any convenient method.



Here we use a notch to match similar work on the threads.



Heavier wire is used for this type of assembly.

Industrial designer, Sid Bersudsky, shows design to client. Can he protect it under existing legislation? Most unlikely.

How long before someone pirates this design?

Canadian designs, like that originated by the industrial designer, above, can be legally copied because no protection is afforded under existing legislation. Even proposed legislative changes do not improve the situation. Here is a vital discussion by a Canadian authority who outlines ways for remedying the situation before it's too late.

J. R. Johnson, *manager Canadian Patents & Developments Ltd.*

The term "industrial design" is gradually coming into common usage. Since the National Industrial Design Committee was formed in 1948 to help promote good industrial design, the general public has come to accept the term even if it doesn't know quite what it means. In general, it has become associated with articles in which the shape is controlled by the function and good design results in a pleasing appearance, good performance and economical production.

Good design is seldom achieved by accident. It may be the result of years of hard work and modification or clever work by a team of skilled designers. In any case a good design is a valuable piece of property and it should be protected from theft just as any other property. As Canadian industry has grown and has started to develop more of its own original designs, there has been a growing demand for some effective means of protecting these designs from theft by copying.

Neglects modern meaning

The Industrial Design and Union Label Act exists on the Canadian Statute Books and many people have thought this was intended to give protection to the type of industrial design covered by the modern meaning of the phrase. But those who have attempted to use it, have found it does not cover what they expected. It actually provides for registration of industrial designs and penalties for copying of registered designs and it soon becomes apparent that what the law makers meant by "industrial design" when they drew up the Act and

what the modern manufacturer means by the term are two entirely different things.

The present Act does not define "industrial design" but it makes it quite plain that the phrase is meant to apply to decorative design used in industry. Section 11 states as follows:

> *"During the existence of such exclusive right, whether of the entire or partial use of such design, no person shall without the license in writing of the registered proprietor, or if assigned, of his assignee, apply for the purpose of sale such design or a fraudulent imitation thereof to the ornamenting of any article to which an industrial design may be applied or attached, or publish, sell or expose for sale or use, any such article as aforesaid to which such design or fraudulent imitation has been applied."*

The underlining has been added but this illustrates the purpose of the Act and the courts have interpreted it in this way.

Covering only ornamental design it is no wonder that very little use has been made of the Act by industry. With the modern emphasis on functional design in which there is very little separate ornamentation, it is difficult to see how the law makers' concept of industrial design could be of any use except in the textile and wallpaper industries.

Royal Commission probe

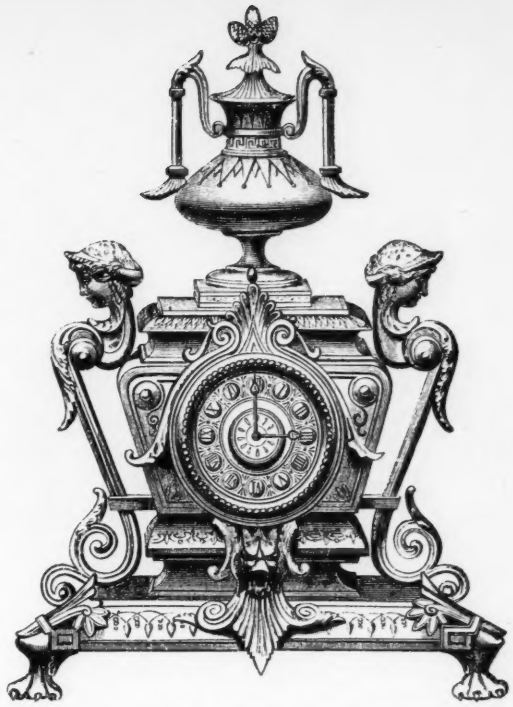
A few years ago revision of the Patent Act, Copyright Act and Industrial Design Act was considered desirable and in June, 1954 a Royal Commission was set up

> *"to inquire as to whether Federal legislation relating in any way to patents of invention, industrial designs, copyright and trade marks affords reasonable incentive to invention and research, to the development of literary and artistic talents, to creativeness, and to making available to the Canadian public scientific, technical, literary and artistic creations and other applications, adaptations and uses, in a manner and on terms adequately safeguarding the paramount public interest, the whole in the light of present day economic conditions, scientific, technical and industrial developments, trade practices and any other relevant factors or circumstances, including practices under or related to the said legislation and any relevant international convention to which Canada is a party."*

On August 20, 1954 a questionnaire was circulated to those who the Commission thought would be interested in Industrial Design protection. Nineteen individuals, industries and associations made representations to the commission either by appearance at the hearing or by filing statements. Of these only four were manufacturers and three were manufacturers' associations.

Industry not interested

The lack of interest by industry generally was probably due to the fact that very few industries, at the time, were interested in creating new products or new designs and the few that were had found there was no chance of protection under the Industrial Design Act. Perhaps it was due to the wording of the questionnaire. The first question was: "Have you any recommendations to make, consistent with the public interest, which, in your opinion, would stimulate Canadian artistic talent in the field of industrial designs?" The emphasis on artistic talent made it apparent that the commission was concerned with artistic design and ornamentation in line with the old act. Those manufacturers who were doing original product design knew from experience that this was not the type of protection they required and, I suspect, decided not to bother.



Elaborate decoration on this clock can be covered under the present Act. Yet a simple clock which does nothing more than tell time is unprotected.

The Royal Commission's report was published in 1958. It is apparent that there still was not much interest shown by industry. The large foreign-owned subsidiaries got their product designs from the parent companies. Most of the smaller independent companies were content to copy foreign designs and there was a certain amount of fear that strong design protection would interfere with this practice. The small group of professional industrial designers, who were strongly in favor of protection, were looked on with suspicion since they had a vested interest. As the commission stated in its report, there was a good case to be made for no protection at all. But it decided some form of protection was desirable and went on to examine the type of protection offered in other countries. It recommended the form that should be taken for an act to protect industrial design in Canada.

Signs of change

In the short time since the Commission finished its work the industrial climate in Canada has changed very rapidly and there are signs of even more important changes in the future. Great emphasis is being placed on various ways of improving Canadian industry to increase exports and produce more locally manufactured goods. It is becoming apparent to even the smallest

Elaborate decoration on this chair can be protected under proposed changes to the Act. Yet it serves no function.

This chair's design can not be protected under the recommendations since its shape is dictated by its function.

local industry that Canada cannot compete, either at home or abroad, with low-labor-cost countries if she produces the same products using the same designs copied from these countries or from a third source. If we are to keep our own markets and win others we must have superior products and they can't be superior if they are copies.

With this in mind, maybe it is time for a second look at design protection. The man who was not interested five years ago may still not be too aware of what it means to him, but in another five years it may be very important. The time to think about the subject and ensure that any new legislation is adequate is now.

Despite the fact that the old concept of industrial design was apparently unsuitable, the Royal Commission recommended a definition which is even more restrictive:

> *"In this Act the expression 'design' means features of shape, configuration, pattern or ornament applied to an article by an industrial process or means, being features which in the finished article appeal to and are judged solely by the eye, but does not include a method or principle of construction or features of shape or configuration which are dictated wholly or partly by the function which the article to be made in that shape or configuration has to perform."*

This definition implies that design is something applied to an article (not an inherent part of it) and that it must not cover anything which is related wholly or partly to the function of the article. It is extremely difficult to visualize any manufactured article that could possibly come under such a definition and still be considered good design by modern standards.

The definition is clearly intended to confine the Act to decorative design only. If this is all it means to cover, the name of the Act should be changed to the Decorative Design Act or something similar to avoid confusion. The recommendations of the Royal Commission are probably excellent for an act to protect decorative design and possibly there is need for such an act to cover textile and wallpaper designs. But it is clear that any protection for "industrial design" as it is understood by the engineer, the industrial designer and the manufacturer must be obtained elsewhere.

Clearing the confusion

The confusion over the meaning can perhaps be cleared somewhat by considering the history of design protection legislation. As I understand it the original intent was solely to differentiate between works of art, which were protected by copyright, and artistic designs which were mass produced as an article of commerce or used to decorate such an article. This is still apparently the basic idea of design protection legislation and the "sons of Martha" may just as well get used to it. If you write a book, paint a picture or mold anything into a special shape you can obtain protection by copyright for your brain child for your lifetime, plus twenty-five years. The result of your efforts can be good or terrible, it makes no difference so long as you do not manufacture it. If you spend the same effort and ingenuity in producing a design for anything that will be manufactured and used, then you can have no protection whatever unless what you have done is considered patentable invention. These are the facts of life.

A strong case could probably be made for copyright protection for engineering and industrial designers, on the grounds that their designs are the result of creative ability every bit as much as the novel or the picture that is now protected by copyright. There have been several proposals for changes to the Copyright Act

to cover industrial designs but none have really cleared up the problem of different meanings for the term "industrial design". While it might satisfy the ego of the designer to have copyright in his design I doubt if it would be of much practical value to industry.

If Canada is to develop into a country with a distinctive industry capable of competing in its own and world markets, then there must be some encouragement for the creation of good designs. The subsidiary companies may not be interested in this and any action will probably come from the independent Canadian companies or, if they have not awakened to the need, possible interested groups who can foresee the requirements.

A new name needed

If the lawmakers insist that "industrial design" must be covered by the definition proposed by the Royal Commission and that the Act must cover only decorative design used in industry, then the least they can do is to modify the phrase to "decorative industrial design". The type of design which the manufacturer needs to have protected will have to be named differently to distinguish it. I suggest "product design".

"Product design" may require a separate act to protect it but it is possible that something could be done under existing legislation. As in all matters of good design the first and most difficult part is to define exactly what is required. There is much room for argument here but the following might be acceptable:

(a) protection shall be provided for manufacturers against theft of original product designs by copying;
(b) protection shall be for designs of articles produced and sold only. This would prevent anyone from trying to obtain a monopoly by covering a large number of possible designs;
(c) protection shall cover complete articles or possibly complete components and not basic principles;
(d) protection shall be relatively cheap and easy to obtain so as not to favor the large company;
(e) protection shall be such as to prevent fraudulent or frivolous use;
(f) protection shall be for designs in current production only.

Try looking elsewhere

Before considering completely new legislation to meet these requirements, perhaps existing legislation should be examined to see what help can be obtained there. It is apparent that the existing Industrial Design Act is not suitable and it is equally clear that the changes proposed by the Royal Commission will not improve matters. Since the requirement is to prevent one manufacturer from obtaining an unfair advantage over another by stealing his designs, perhaps there is hope of protection under the Trade Marks and Unfair Competition Act.

An examination of the Trade Marks Act shows that it covers quite a large group of practices that are considered to be unfair competition. These are covered in Section 7, which reads:

No person shall

(a) make a false or misleading statement tending to discredit the business, wares or services of a competitor;
(b) direct public attention to his wares, services or business in such a way as to cause or be likely to cause confusion in Canada, at the time he commenced so to direct attention to them, between his wares, services or business and the wares, services or business of another;
(c) pass off other wares or services as and for those ordered or requested;
(d) make use, in association with wares or services, of any description that is false in a material respect and likely to mislead the public as to
(i) the character, quality, quantity or composition,
(ii) the geographical origin, or
(iii) the mode of the manufacture, production or performance
of such wares or services, or
(e) do any other act or adopt any other business practice contrary to honest industrial or commercial usage in Canada.

Section (e) would seem to cover what is needed for "product design" protection since the direct copying of another manufacturer's original design would certainly appear to be a business practice contrary to honest industrial or commercial usage in Canada.

Something more definite than clause (e) would obviously have to be worked out and this would require a great deal of study. A workable system of protection might be:

(a) Each manufacturer who produces and markets an article for which he claims original design will mark it with the "design date". This will be the date on which he first places this article on the market. This takes the place of registration. The article itself is the complete description and the date establishes his priority claim. This costs nothing for the manufacturer and involves no staff or expenditure for registration.

(b) If the manufacturer finds that a copy of his design is being produced and it is harming his business sufficiently he may sue under the Trade Marks Act. The article in question is the design. The design date is established. The Court will decide if the competing article is a copy. If it has a later design date or no design date, then sale of the article would be ruled unfair competition. The defense would be to show that the design was not original by producing other articles of the same design which antedated the one covered by the design date.

(c) The period of protection would have to be established and this might vary with different classes of product. Five years would be adequate in many cases but ten years might be applicable in others. In most cases changes would be made in a design within five years which would make a new design date applicable.

Proposed changes

In order to make provision for a system of design protection such as above a few changes could be made in the Trade Marks Act, as follows:

Sect. 2. Interpretation.
add (x) "design" means the sum total of all the features of an article of manufacture as represented by the complete article.
(y) "design date' means the date of introduction to the market of an original design.
Sect. 7. Unfair Competition and Prohibited Marks. No person shall
insert new clause (e) offer for sale any article of manufacture which is a direct copy of an article produced by another manufacturer which is an original design and bears a design date which falls within the preceding five years.
change present clause (e) to (f).

The effect of the proposed changes can be summarized as follows:

- A manufacturer could sue under Section 7 anyone who offered for sale a direct copy of his original design, provided that he had marked it with his design date and provided that this date was within the previous five years or whatever other period is established.
- The courts would decide if it was an original design and if the competing article was a direct copy, and assess damages.
- There would be no registration of design and no restriction against use of any inventions, principles of construction, or any feature, by other manufacturers provided that the article itself was not a direct copy.
- A manufacturer would have to declare his "design date" by marking his article to obtain protection.
- At the end of the protection period the design would be public property.
- It would be impossible to cover a large number of designs and restrict the trade of others since protection would only be possible on articles placed on the market and marked with a design date.
- The manufacturer would have protection against direct design piracy.
- The designer would have no direct protection but would benefit from the manufacturer's protection on his designs.
- The public would be protected against shoddy copies of good designs.
- Everyone would know at all times which designs were claimed to be original and the date of the claim.
- The courts would have clearer grounds on which to base decisions relating to design copying.

The detailed revision of the Trade Marks Act is obviously a job for those who are skilled in these matters and there are probably flaws in the wording as proposed. Nevertheless it seems that a form of protection for "product design" could be obtained in the way proposed, and "product design" as distinct from decorative "industrial design" would appear to be something well worth protecting. ★

The author

J. R. Johnson is manager of Canadian Patents and Developments Limited, the licensing agency which handles inventions belonging to the Canadian government. A graduate mechanical engineer (McGill '34), he was a member of the disbanded National Industrial Design Council and chairman of the committee set up to study the problem of design protection. However his views are entirely his own, since the committee never made its report.

How well do you know your magnesium?

Another in the challenging series to test your memory of the design characteristics of the more important engineering materials. This time we ask how well you know your magnesium.

The questions and answers were supplied by H. G. Warrington, sales and technical service manager of Dominion Magnesium Limited, Toronto.

Question 1
What elements are added to magnesium alloys to make them free machining?

Question 2
Which is heavier, aluminium or magnesium, and by how much?

Question 3
A magnesium structure is rivetted with aluminium alloy 5056 rivets. Which will corrode by galvanic action?

Question 4
What element is added to magnesium to increase its resistance to heat?

Question 5
With what element would you alloy magnesium to obtain a strong alloy capable of damping out high frequency vibrations?

Question 6
What have oil and gas pipelines in common with water heaters and battleships that concerns magnesium?

Question 7
What is the most startling effect of magnesium known on the behaviour of another metal?

Question 8
What are the effects of magnesium on aluminium?

Question 9
What elements will refine the grain of magnesium alloys?

Question 10
What grades of pure magnesium can be obtained?

Question 11
Can magnesium be anodized?

Question 12
What is the most popular structural use for magnesium alloys?

Question 13
How is magnesium welded?

Question 14
What structural light metals, other than magnesium, are produced in Canada from Canadian ores?

Question 15
What is the most recent discovery of the effect of magnesium on another metal?

Now check your rating. Turn to page 76 for the answers.

Get the heat where you really want it

Through research and constant product development unit heater manufacturers can offer a specific type of unit for every heating need.

The unit heater has come a long way since the prototype was invented about 40 years ago. The first lightweight, suspended unit heater, was simply an auto radiator connected to a steam line, with a fan mounted behind it.

The designer, who was just starting in business as a radiator manufacturer, hooked up the new gadget as a substitute for a worn-out pipe coil heating system in the old factory that was his company's early headquarters. By turning on the fan behind the radiator, he was able to direct a stream of warm air toward the area where he was working.

From this humble beginning, a whole new industry was born. Today, finely-engineered unit heaters are available in a wide variety of types and models to meet every conceivable space heating need. They also are used for other applications such as drying and fresh air circulation.

The continuing popularity of the unit heater is based on several inherent advantages, including economy and easy adaptability to changes in heating requirements. Anyone who is planning a heating system for an industrial, institutional, or commercial building would do well to take a second look at these features of unit heaters:

- Heat is delivered where and when it is needed without any waste.
- The pattern of heat distribution is even and uniform without great differences in temperature between floor and ceiling.
- Instant heat is provided without slow warmup.
- No other method lends itself so easily and economically to zone control. For example, when heating needs decrease because of wind direction or shifts in plant production, it is a simple matter to turn off those unit heaters which are not required at that particular time.
- The layout of industrial and commercial buildings can be rearranged without extensive changes in the heating system.
- Unit heaters also offer one of the most inexpensive and effective ways of introducing, tempering, and circulating fresh air for ventilating purposes.

Since the first lightweight, suspended unit heater was invented a great deal of research has gone into the development of different types that would meet new application requirements. That's why today you can find a unit heater for every space heating need.

To help you select the right unit heater for any job which you may be called to work on, here is a rundown on the many different types available today.

Propeller types are popular

There are three distinct types of propeller unit heaters in standard models for hot water and steam systems. These are the horizontal delivery, vertical delivery, and high velocity. The term **standard** in this sense means those unit heaters which are used with steam pressure of less than 30 psi for heating, or up to 150 psi for drying applications.

The primary difference between the three types of propeller units is the velocity and/or the direction of the air stream. Selection of a propeller unit should be based not only on the type, but also on the recommended mounting height, sound level, and size.

Thus, in industrial buildings especially, a combination of all three types may provide the best answer to various heating problems. A typical combination might be found in a monitor building with a central craneway and large doors at each end of the structure. Verticals could be chosen for the areas below craneways, horizontals for the low ceiling areas, and high velocity units for the ends of the building to offset heat losses when the doors are opened.

Horizontal delivery unit heaters are the most widely used for general industrial and commercial applications. Connections for supply and return pipes are located near the center of many models so that the unit heaters can be suspended directly from the supply line without other supports. Thus, the air stream of the heater can be rotated over 360 degrees to meet changes in heating requirements.

The maximum mounting height for standard horizontal models ranges from about 8 to 17 feet, depending upon the size of the unit heater and whether it is used with a steam or hot water system. The mounting height with hot water models generally can be slightly higher than with steam systems.

Information on mounting heights and heat throw in this report is based on standard operating conditions of 2 pounds steam pressure, 60F entering air temperature, or an average water temperature of 220 F. All values should be used only as guides since they will vary with different makes of unit heaters and different operating conditions.

Sound levels on horizontal unit heaters are comparatively low so that smaller models can be installed in classrooms, assembly halls, hospitals, and similar buildings if the motor is operated at reduced speeds.

Vertical delivery units are particularly well suited for buildings with high ceilings, or where extra storage space or head room is desired. The velocity and spread of heated air from vertical models can be varied considerably by using different air deflectors. For example, with a cone-jet deflector, a large standard vertical model on a steam system can be mounted as much as 55 feet over the floor to spread heated air over an area almost 60 feet in diameter. Without deflectors, verticals can be mounted as high as 39 feet to provide a heat spread of about 75 feet.

On the largest vertical models, the outlet air velocity is more than double that of the biggest horizontal units. The sound rating is such that some vertical models can be used in stores, restaurants, and private offices at reduced motor speeds.

High velocity unit heaters deliver a high-velocity, horizontal air stream over exceptionally long distances so that heat can be delivered as much as 150 feet. Because of this long heat throw, they often can be used in warehouses or other industrial buildings to replace a larger number of horizontal delivery units.

These units are especially suited for heating large areas and offsetting heat losses from big doorways. Maximum mounting height is 16-20 feet on steam systems, 18-22 feet with hot water.

Specials for dusty areas

Propeller unit heaters with low outlet temperatures are available in the same three types as the standard propeller units, but are intended primarily for steam systems where pressure exceeds 30 pounds and where it is desirable that outlet air temperatures approximate those of standard models on lower steam pressure.

Low outlet temperature models are ideal for areas that are extremely dusty because they have a wider fin spacing that reduces clogging. The low outlet temperatures also make it possible to install these units at unusually high levels—up to 68 feet on large vertical delivery models with cone-jet deflector.

Blower types used, too

Used on steam or hot water systems, the blower type unit heater or heating and ventilating unit consists of (1) the basic fan section to move air and (2) whatever coils or accessories are desired for a specific heating and ventilating job.

This type of unit heater can be used for straight heating and for introducing and tempering of fresh air for ventilation or makeup air. It can be installed as a central station heating unit with ducts, and also without ducts.

Possible applications are almost endless because of the flexibility in the use of accessories, and the fact that fan sections are available in many distinct types.

For example, one manufacturer offers a choice of two types of coils, three filter boxes, two mixing boxes, internal or external face and bypass dampers, discharge or intake plenums, humidifiers, and discharge nozzles.

The different types of units are for horizontal, ceiling-suspended, inverted, vertical, and free-standing installation. The equipment is used in industrial, institutional, and commercial buildings of all types.

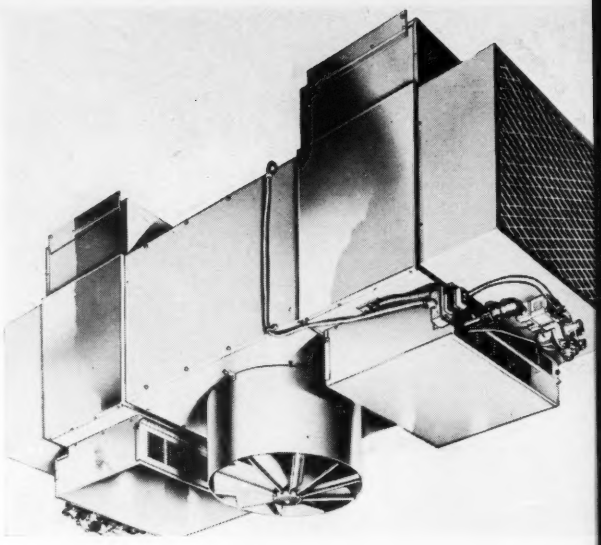
Electric unit heaters

Easily installed, electric unit heaters require no piping, pumps, boiler, or furnace. In this way, they offer important savings in installation and maintenance costs. Electric unit heaters can be mounted by suspending them from the ceiling or by supporting them from the wall or ceiling with an optional bracket.

Maximum mounting heights range from 8 to 12 feet and the heat throw from 18 to 47 feet. The outlet velocity on a large electric unit heater is comparable to a large horizontal delivery model operating at high speed.

Gas-fired heaters

This type of unit heater, made by one manufacturer consists of two duct furnaces that are interconnected by means of an enclosure that houses a fan, motor, and a radial assembly air distribution device with readjustable blades. The gas-fired, industrial type, vertical delivery unit heater can deliver large volumes of air at high velocity and comfortable final air temperatures.



The mounting height can be as much as 36 feet above the floor when the deflector blades are pointed straight downward. Thus, the unit can be installed in out-of-the-way places above the craneways or other factory equipment. It also is ideal for garages, hangars, and for warehouses that want to use the maximum of storage room.

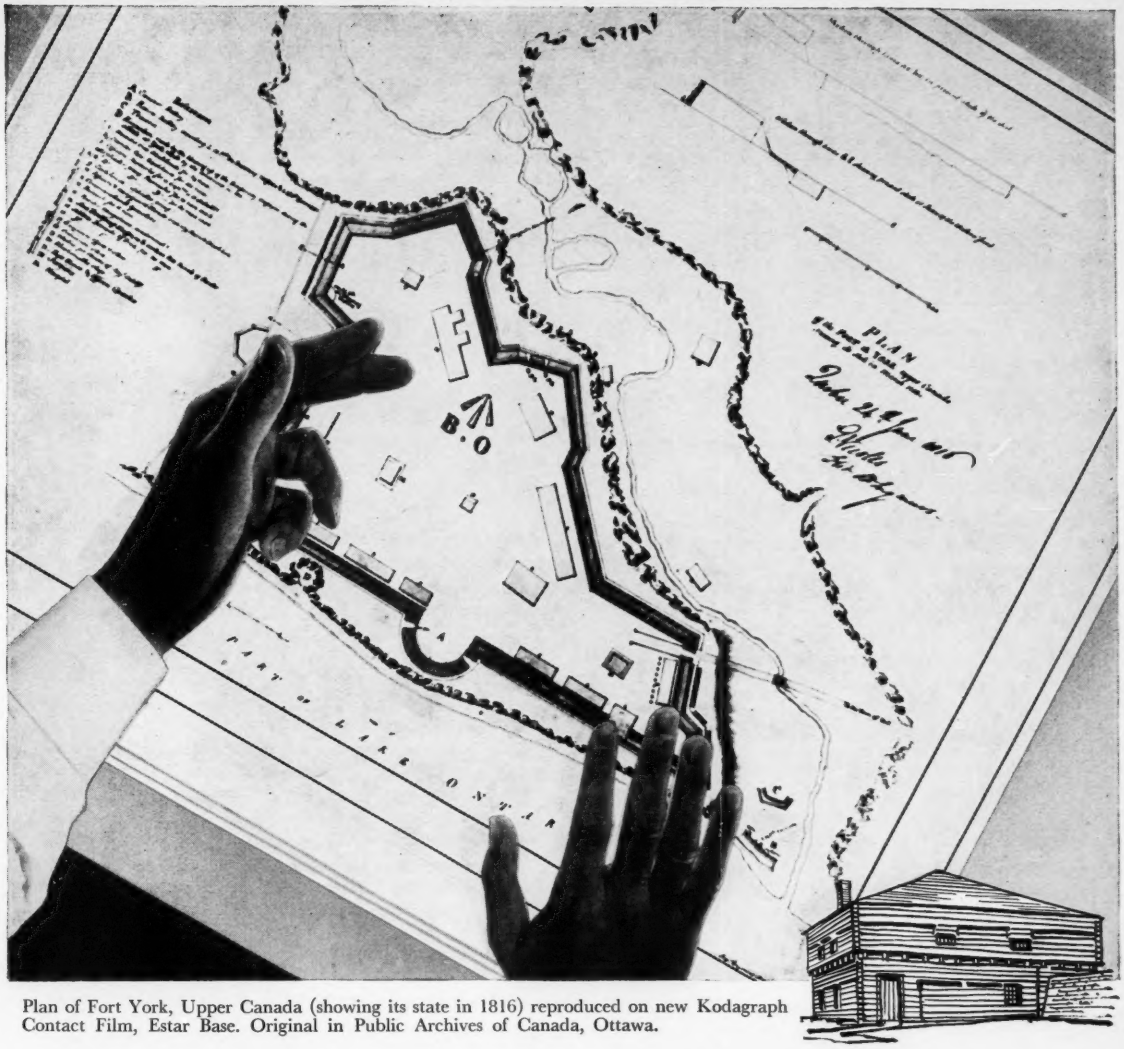
Unlike heavier blower units, the gas unit is lightweight and can be suspended directly from existing structural parts of the buildings. In addition to heating, it is used with ducts for introducing and recirculating fresh air for ventilating purposes.

Unit heater manufacturers have kept pace with the rapid increase in natural gas supplies by developing both propeller and blower-type units for use with this fuel. If natural gas is not available, these unit heaters can be operated on mixed or LP-gas. Since gas-fired unit heaters require no boiler or furnace, more units can be easily installed when additions are built onto existing factories or commercial buildings.

Propeller-fan types, installed in the space which they are to heat, are generally used for most heating applications. Blower units are recommended where extremely quiet operation is desired, where duct work is employed, or where ventilation, air filtration or cooling are required. Installed with duct work, the blower units can be located so that they will serve more than one room. Automatic controls can be used to regulate heating and cooling requirements within the rooms.

Maximum mounting height for propeller types ranges from 8 to 20 feet and the heat throw from 17 to 55 feet when entering air temperature is 65 degrees. For blower types without duct work, maximum mounting heights vary from 10 to 16 feet and the heat throw at higher motor speed ranges from 20 to 55 feet.

When ducts are used, external static pressures should be given careful consideration in determining heat throw performance. Gas-fired units are suited for supermarkets, bowling alleys, schools, factories, auditoriums, garages, warehouses, and many other types of buildings. ★



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Electrical designs for Great Britain

Designing products for export to foreign countries always presents unique problems. How would you go about designing electric motors for use in Britain for instance? Editor Doug Kaill recently discussed this subject with Bruce Newman, P.Eng., motor engineer with Wagner Electric in Leaside, Toronto. Here is what he learned.

Editor: We understand that you have just completed a survey of the design requirements for electric motors for use in Britain. What prompted this survey?

Newman: A number of our customers are of the opinion that now is the ideal time to get into the export business to Britain with specialized products which have not been developed over there to the same extent as in Canada. These include such items as special purpose pumps, coin operated machines, furnace blowers, etc. They asked us to develop the specifications for motors for these units.

Editor: Are the requirements different than in Canada?

Newman: Very definitely. For instance, they operate on 50 cycles, compared to our standard of 60.

Editor: How about their voltages?

Newman: The consumer supply voltages in different districts in Great Britain may vary from 200 to 250 volts. The voltage in each district is generally stated in terms of the range of the single-phase supply. For instance: 200-210 volts, 210-220, 220-230 and so on to 250 volts. In addition to these there are some districts with other special 50-cycle supply voltages and some with d-c supply.

The most common arrangement for new installations is 3-phase 4-wire grounded neutral, 240/415 volts. Ordinary homes are then served with single phase 2-wire 230 to 240 volts from the distribution circuit. Some larger homes and commercial establishments are served with full 3-phase 4-wire circuit.

Editor: I assume industrial voltages are also in the same groupings.

Newman: Yes, to some extent. The industrial voltages originate with high-voltage sources which normally are stepped down to 3-phase medium voltage, between 250 and 660 volts. At 50 cycles, of course. There is a great variation in the actual voltages, but a common value for new installations is 415 volts, 3-phase, 4-wire. The industrial voltages may also be stated in terms of the range of supply voltage. A range of plus or minus 5% is commonly used, such as 346-380, 380-420, 400-440 and 500-550.

Editor: How are appliances rated?

Newman: Appliances are usually rated with a voltage range, to correspond with one or more of the ranges of supply I have already mentioned. For appliances which are not unduly voltage sensitive, two useful ranges would be 200-220 and 220-250 volts, the latter being the more important of the two. The ampere or wattage rating marked on these appliances is the single value corresponding to the average of the voltage range.

Editor: Are there any special requirements for the connecting and control of equipment?

Newman: The outlets for single phase household appliances are usually required to have a separate circuit fused at not more than 15 amperes and limited to 3 KW connected load per circuit. The total load on a circuit may include several devices, each connected to an outlet on the circuit. In this case, each outlet is individually fused right at the receptacle to suit the load of the particular device. Common ratings for these fuses are 2, 5, 10, 13 and 15 amps. Most new domestic buildings are wired with the 13-amp ring main system, using fused plugs. The receptacles are 3-wire grounding type, to British standards.

The requirements and limits for the size of commercial loads in commercial and industrial installations will depend on the particular distribution system. The general conditions for the size of these loads will be similar to those prevailing in Canada.

Editor: Could you tell us something about motor design requirements?

Newman: The frames of motors usually must be grounded with a connection separate from the "neutral" wire of the supply. Both rigid and flexible conduit are used in connecting motors. However the sheath of flexible conduit is not considered adequate for grounding. Small appliances and fractional-horsepower motors are started directly across the line. Integral-horsepower motors make more use of reduced voltage starting than in Canada. For example, motors of approximately 2 hp and larger usually have reduced voltage starting, by means of a star-delta type starter. Built-in overload protectors are used in some small motors, but not to the same extent as in Canada.

Editor: Is CSA approved equipment automatically acceptable in the U. K.?

Newman: Up to the present there have been no requirements for approval of equipment prior to installation. There is no approvals body quite comparable to the CSA with respect to electrical equipment. The British Standards Institute publishes some general standards on ratings, temperature rise, dimensions and performances. But these are not mandatory. However they are usually followed, and a manufacturer may arrange for a license to mark his equipment as complying with these standards. ★

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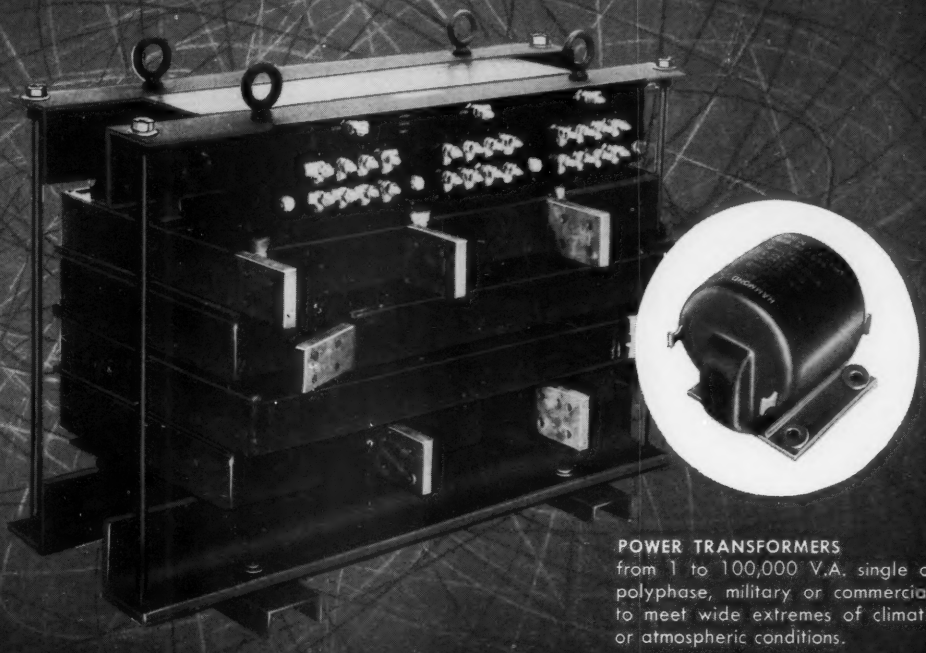

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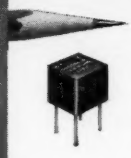
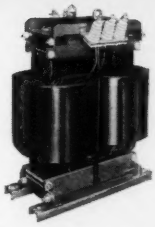
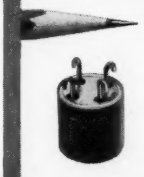
Hammond has produced transformers to more than 59,000 different designs. Where a complex requirement concerns transformers within the ranges listed above, the chances are Hammond has already solved the problem in a similar or related form.

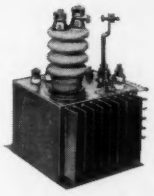


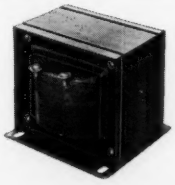
AUDIO TRANSFORMERS
from microphone level to 10 KW, for broadcast or public address, computer or sonar—transistor or tube circuitry.





PULSE TRANSFORMERS
for ultra-miniature blocking oscillator and coupling transformers or high-power modulators and associated linear charging reactors.





REACTORS
for smooth and precise electronic control: filter reactors, swinging chokes, saturable reactors, charging reactors, parallel-feed chokes.

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Standard Items Stocked by Leading Jobbers

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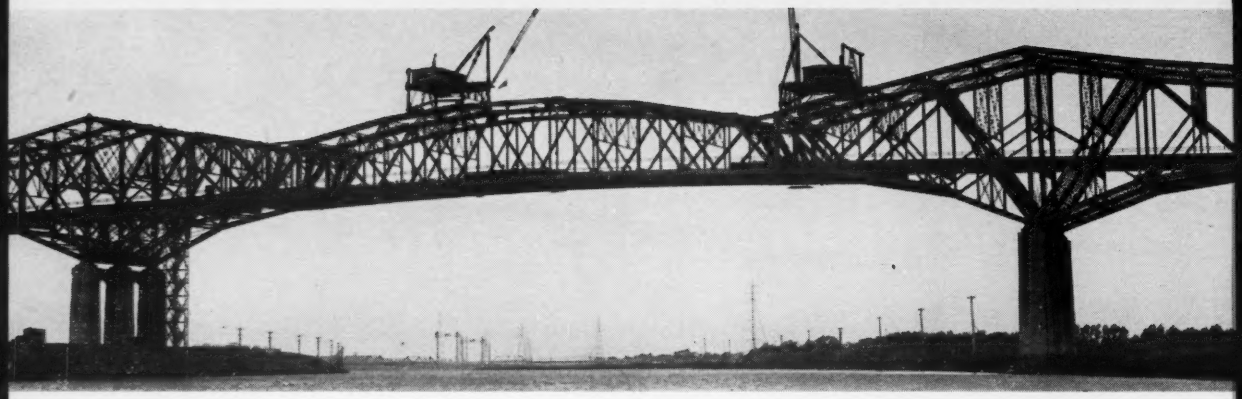
For further information mark No. 136 on Readers' Service Card



A new approach to closing the gap

Canadian bridge engineers devised a wedge and toggle system for closure of Montreal's new Champlain bridge

The wedge and toggle system, devised by Dominion Engineering, adds a new idea to a method used on the Jacques Cartier crossing.

Not surprisingly, the most intricate part of building a suspension bridge is closing the gap in the steelwork when the two sides meet in the middle. But structural engineers who have just finished working on Montreal's new Champlain bridge have found a fresh approach to an old technique.

The bridge is a three-truss structure containing a total of 11,000 tons of steelwork. It provides a clear main span, from pier to pier, of just over 700 feet. Overall length, including approach spans, is 2,485 feet.

The gap to be closed stood 120 feet above the St. Lawrence Seaway channel near Laprairie. It was in the main suspended span 385½ ft. long. Engineers ordered six hand-cranked ten-ton wedges similar to those used on the Jacques Cartier crossing thirty years earlier. These, together with an ingenious toggle system (not used before) were positioned at the junction of the suspended span and the cantilever arms at either side. The wedges were placed at the bottom and the toggles, activated by 500 ton capacity hydraulic jacks, were applied to the top chords. This gave support as the steelwork was erected in cantilever fashion.

To compensate for sag each half section of the suspended span was erected with a slight upward camber. The result at the center was a slight gap between the ends of the top chords and an overlapping of the bottom chords.

When the steelwork was completed but unconnected at the center the load on each wedge was 1,240 tons. This was reduced to 880 tons for the closure operation by withdrawing the traveller derricks from the suspended span to the cantilever arms.

Steelworkers drew the bottom chords into alignment by lowering the wedges. At the same time other crews bled the jacks on the toggle mechanisms to extend the top chords and bring them together at the center. All crews kept in touch via telephonic communication directed from the central closure position.

A 15-ton top chord dropped into position and finally pinned and bolted, marked the completion of the steelwork job. This done other crews moved in to put the finishing touches to a four-mile, three-lane double highway which will be open to Montreal motorists next year.

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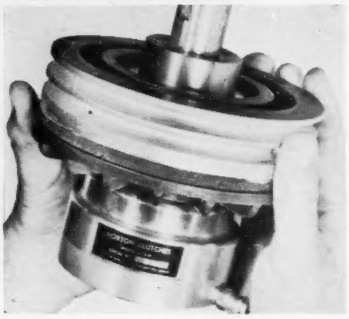
New products and materials

Combination clutch



A new clutch for drives up to 1½ hp. It incorporates quick acceleration and shockless starting features, and has 16 drive ratios with stock sheaves. Both V-built and pilot adapter drives are available. **Acme Chain & Gear Ltd.**

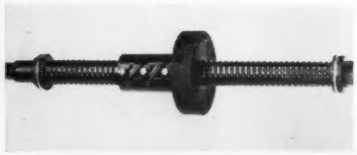
Circle 301 on Reader Service Card

Screw drive

A screw conveyer drive designed for short conveyor flights and low horsepower requirements. Consists of a double reduction speed reducer with packing gland and driving shaft which mounts on a trough end. There are two speed ratios: 8:1 for up to 6 horsepower and 225 rpm; 18:1 for up to 3.8 hp and 100 rpm. **United Steel Corporation Ltd.**

Circle 302 on Reader Service Card

Ball-bearing screw



Feature is a reliable low cost method of limiting the travel of the nut at predetermined positions with continuing rotation of the ball-bearing screws. A set of three washers, two steel and one nylon, replace the conventional stop-pins. Mechanical efficiency range from 90 to 95% is claimed, with no tendency for the units to creep under load. **Saginaw Division General Motors Corp.**

Circle 303 on Reader Service Card

Molding compounds

A single component epoxy molding compound that cures in 15 seconds. Dry and granular, the compound is non-burning and offers a storage life of at least one year at room temperature. **American Marietta Co.**

Circle 304 on Reader Service Card

Level safety switch

A new switch designed for installations with bearings, packing glands and motor windings and which depends on pumped water for lubrication and cooling. It mounts on the pump discharge line and is connected in series, with the pump motor power supply. A micro switch electrically disconnects the pump motor. **United States Gage**

Circle 305 on Reader Service Card

Flat-top belting

A new line of flat-top hinged steel conveyor belting providing a continuous load supporting surface for above floor or flush-with-floor installations. Secret is end curve, interlocking and overlapping steel built links. **May-fran Manufacturing Company.**

Circle 306 on Reader Service Card

Paper insulation

A paper that withstands temperatures up to 3000F in intermittent operation. Made from quartz fibres, it can also be used in temperatures as low as minus 459F. Possible applications include thermal blanket and high-temperature laminates, while it can be impregnated with phenolic resin for ablation and heat shielding where standard paper form is not suitable. **C. H. Dexter & Sons Inc.**

Circle 307 on Reader Service Card

Electro-pneumatic converter

A new highly versatile unit that converts a d-c voltage or current into a pneumatic pressure signal. Will accept electrical imput signals of one to 9 volts or milliamps d-c, or one to 5 volts or milliamps d-c. Pneumatic output signal ranges: 0 to 30, 0 to 15, 3 to 27, 3 to 15 psi. **Hagan Corp. Canada Ltd.**

Circle 308 on Reader Service Card

Filter assembly

A filter unit which gives 3-micron cleanliness for hydraulic and other petroleum based fluids and water. It requires no recirculation or preliminary filtration. A combination fiberglass membrane primary throwaway cartridge has large dirt capacity. **Aircraft Porous Media Inc.**

Circle 309 on Reader Service Card

Small speed reducer

The unit has a gear ratio of 25:1 and is claimed to transmit up to .95 hp at maximum recommended output speed of 85 rpm. Pre-determined combination of reducer and V-built drive can provide any speed ratio up to 175:1. **United Steel Corp. Ltd.**

Circle 310 on Reader Service Card

Temperature control

A new compact, remote bulb, high temperature indicating control for ovens, test equipment, plant processes and laboratory applications. Claimed accuracy and sensitivity range is 100 to 1000F. **United Electric Controls Canada Ltd.**

Circle 311 on Reader Service Card

Flexible shaft link

A new flexible shaft core is designed as a steering link to automobiles, trucks, and tractors. Available in ⅝ inch or ¾ inch sizes the shaft can be deflected 20 degrees sideways making it easy to get in and out of vehicles. In a crash the shaft would collapse. **Stow Manufacturing Co.**

Circle 312 on Reader Service Card

Compressed air unit

A single package unit for filtering, regulating and lubricating compressed air. It is only 7 inches long and 3¾ inches high. Feature is a completely automatic drain trap on the filter. **Wilkerson Corporation.**

Circle 313 on Reader Service Card

Gas valve

A valve with a resilient teflon ring as the main poppet seal. When the valve is

(Continued on page 74)

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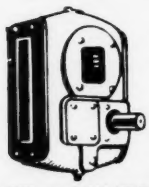
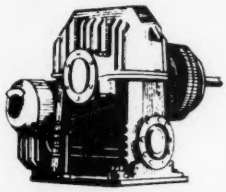
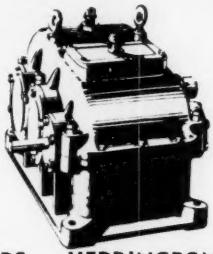
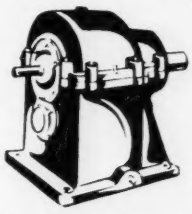


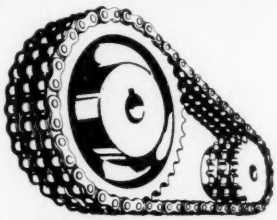


SHAFT MOUNTED & WORM GEAR REDUCERS





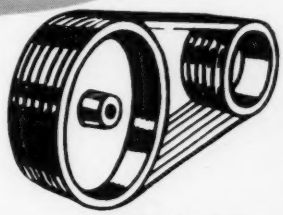
HERRINGBONE GEAR REDUCERS



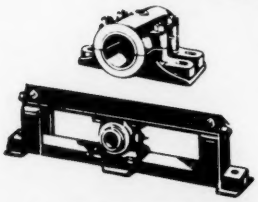
ROLLER CHAIN DRIVES

GEARING

PULLEYS

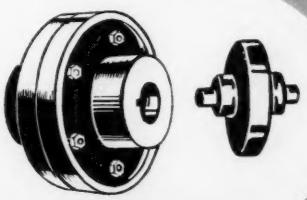


V-BELT DRIVES



PILLOW BLOCKS AND TAKE-UPS

CHAINS AND SPROCKETS



COUPLING AND CLUTCHES

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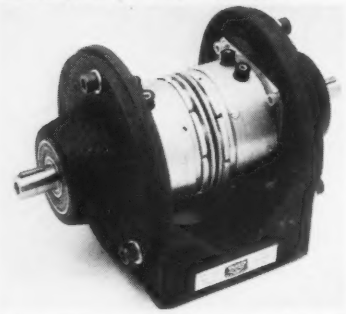
opened the pressure differential forces the seat out of the path of foreign particles in the stream. When closed the teflon is prevented from cold flowing by an overlapping metal seat. O-ring seals are designed to shrink tighter as the temperature decreases. This valve resists vibration and leakage beyond 3,000 psi. **Valcor Engineering Corp.**

Circle 314 on Reader Service Card

Stationary field clutch



A new Warner clutch available from 1.5 lb-in. to 1,350 lb-ft. The field is supported by a double seal, single row ball bearing including high temperature lubricant and seals. Offered in a variety of bore sizes, it is claimed to be easier to mount and align, and eliminates the need for slip rings and brushholders. **Knowles & Foster Ltd.**

Circle 315 on Reader Service Card

Pressure relief valve

A cushion type pressure relief valve incorporating two independent cartridge relief valves. Developed originally as a brake in the swing circuit of a backhoe, the unit provides overload protection for any actuator subject to fast reversals of load. At full rated flow of 300 gpm differential is less than 100 psi from trickle to full flow and less than 50 psi between cracking and closing pressure. **Fawick Corp.**

Circle 316 on Reader Service Card

Starter relay

A push-on type current motor starting relay for use on hermetic compressors with tin-type terminal clusters. Relay cover and spool are made of strong, high temperature phenolic. **Metals and Controls Inc.**

Circle 317 on Reader Service Card

Angle plate

An angle plate made of diabase in the form of an "H" instead of the usual "L" and "T" designs. The face of the H-section provides more space for clamping, while the symmetrical design ensures uniform wear. **Alexander Tools Ltd.**

Circle 318 on Reader Service Card

Time delay relay

A relay of greatly reduced size and weight which uses two half size crystal can relays. Weighs 1½ ounces and is only 1 cubic inch in size. **Leach Corporation.**

Circle 319 on Reader Service Card

Heavy-duty timers

A new series designed for camshaft speeds from one to 600 rpm. Timer can be furnished with from 1 to 12 circuits (15 amp coin silver contacts) for operation on 115 volt, 60 cycle. **Davis Automatic Controls Ltd.**

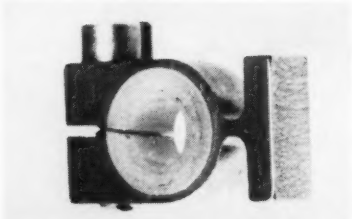
Circle 320 on Reader Service Card

Silicone resins

Metal-filled silicone resins are available commercially. Metal-fillings available include lead, bronze, steel, copper and aluminum. **Furane Plastics Inc.**

Circle 321 on Reader Service Card

Insert clamp



A new clamp made of nylon and available in ⅛, ¼ and 3/16 shaft sizes. 85 different types cover balanced, unbalanced, gear, hinged, pool and swivel clamps. **Sterling Precision Corp.**

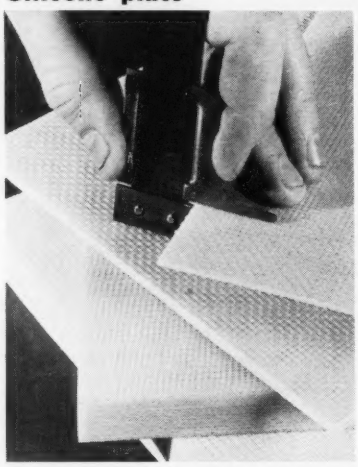
Circle 322 on Reader Service Card

Discharge tubes

Hollow-cathode discharge tubes for atomic absorption spectroscopy analysis of materials containing iron, copper, nickel, zinc, manganese, magnesium, calcium and other elements. Features include low starting voltages, low operating voltage and stable current. Output spectral lines are narrow and steady after a short warm-up. **Canadian Westinghouse.**

Circle 323 on Reader Service Card

Silicone plate



An economy grade silicone plate developed for general applications requiring class "H" insulation temperatures. Impact strength is 20 ft lb per inch for ⅛ inch thick plate and 25 ft lb per inch for ½ inch plate. Flexural strength flatwise with grain is 20,000 psi for ⅛ inch plate. **Westinghouse Electric Corporation**

Circle 324 on Reader Service Card

Epoxy adhesive

A new moderately priced conductive epoxy filled with silver. Volume resistivity when cured is .01 ohm-cm at 25C. Water absorption after 24 hours is .1% and shrinkage during cure .15%. **Conap Inc.**

Circle 325 on Reader Service Card

Sub-fractional motors

A new line of explosion-proof sub-fractional horsepower motors available in 1, 2 or 3 phase induction for synchronous types from 1/150 to 1/20 hp. Torque or dynamic brake types are also available. 2, 4 and 8 pole models give corresponding synchronous speeds of 3,600, 1,800, and 900 rpm. **Technology Services Inc.**

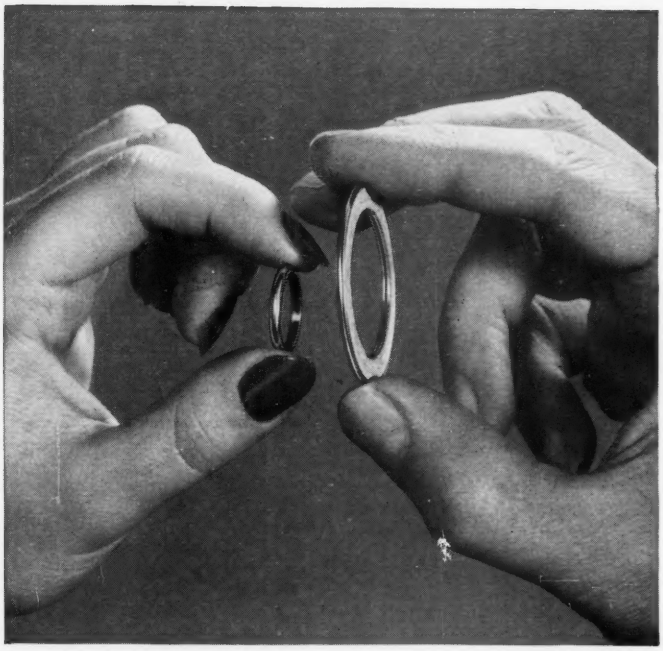
Circle 326 on Reader Service Card

Suspension meter

A new ultra-sensitive suspension type panel meter for measuring voltage and current. Special feature is a conical

(Continued on page 76)

GASKETS
in Design
Engineering



New, ultra-thin Garlock GUARDIAN* Gaskets solve the problem of high-temperature, limited-space sealing on missile and aircraft exhaust systems, turbines, other equipment.

At last—a spiral-wound gasket no thicker than a wedding ring! Ideal for limited space or light flange applications, this new Garlock GUARDIAN Spiral-Wound Gasket is available in thicknesses as thin as 1/16" in gaskets up to 6" I.D., maximum flange width 3/8".

Controlled density affords more positive seal. During manufacture of the new "wedding ring" GUARDIAN Gasket, the proper selected thickness of filler material and preformed metal, the number of laminations of filler and metal, and the correct tension of filler and metal while being formed into a gasket are the factors engineered to achieve proper gasket density. By controlling and varying these factors, Garlock is able to match the density to the pressure range. This built-in quality is constantly checked by a Baldwin-Lima-Hamilton compression-testing machine, thereby assuring perfect sealing regardless of different pressures and different bolt-load requirements.

High-temperature, high-strength construction. This new Garlock "wedding ring" GUARDIAN Gasket operates effectively at temperatures as high as +1900°F and pressures to 2500 p.s.i. or more. It is an excellent gasket where recycling temperatures are encountered. In the 700°F to 1200°F range, Garlock uses a compressed asbestos filler with stainless steel plies; in the 1200°F to 1900°F range, a ceramic filler is used with several different types of metal plies, depending on customer preference. The ceramic is non-flammable, completely inorganic, and an outstanding chemical insulator. It resists mold, mildew, and aging, thereby allowing indefinite shelf life.

Where service is severe and space at a premium, use new Garlock "wedding ring" GUARDIAN Gaskets. They may be the answer to your sealing problems. Find out more from your Garlock representative. Call him at the nearest of the 26 Garlock sales offices and warehouses throughout the U. S. and Canada. Or write Garlock of Canada Ltd.

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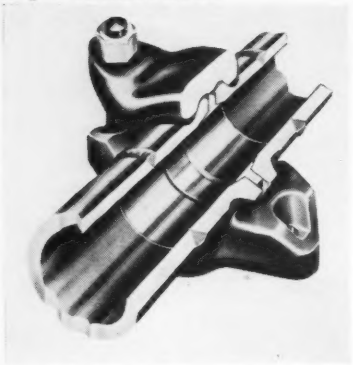
New products

(Continued)

shaped spring anchor which provides resilience for the taut suspension wire when the instrument is subjected to shock from many directions. **Len Finkler Ltd.**

Circle 327 on Reader Service Card

Pipe connections



A new idea using an all metal seal ring with flexible tapered lips on either side of a rigid rib. The lips do the actual sealing against the mating hubs. Taper of the lips is slightly less than that of the sealing surface of the mating hubs, and as the connection is tightened the hubs cause the seal ring lips to deflect. Need for replacement gaskets is eliminated since the seal ring is completely reusable. **Gray Tool Co.**

Circle 328 on Reader Service Card

Filter fabric

A finely meshed filter material of nonwoven acrylic fabric produced by papermaking techniques. Special manufacture is claimed to permit greater control over fibre matting and the bonding of fibres than in the felting or dry processes. **Rogers Corporation**

Circle 329 on Reader Service Card

Flake core

A 550 permeability toroidal core primarily for low audio frequency selective networks. Finds application where molypermalloy powder cores and laminations are now used, and fills the gap between these two components. **Magentics Inc.**

Circle 330 on Reader Service Card

Temperature crayons

A new type of temperature indicating crayon which distinctly changes color within two seconds at plus or minus .5% of the indicated temperature. These sticks may be applied to a cold surface and color change is permanent. Crayons are not fragile and do not shatter when dropped. **Canadian Rockweld Ltd.**

Circle 331 on Reader Service Card

How well do you know your magnesium?

Now check your rating. Here are the answers to the questions on page 64.

Question 1: What elements are added to magnesium alloys to make them free machining?

Answer: None. Magnesium alloys machine faster and take heavier cuts than any other metal.

Question 2: Which is heavier, aluminum or magnesium, and by how much?

Answer: Aluminum is 50 per cent heavier than magnesium.

Question 3: A magnesium structure is riveted with aluminum alloy 5056 rivets. Which will corrode by galvanic action?

Answer: Neither. Magnesium is perfectly compatible with aluminum alloy 5056.

Question 4: What element is added to magnesium to increase its resistance to heat?

Answer: Thorium. Magnesium alloys containing thorium maintain strength to 900 F — higher than any other light metal.

Question 5: With what element would you alloy magnesium to obtain a strong alloy capable of damping out high frequency vibrations?

Answer: Zirconium. An alloy of magnesium with 0.55 per cent zirconium will absorb 67 per cent of vibration energy, compared with 4 per cent for cast iron, and less than 1 per cent for all other structural metals.

Question 6: What have oil and gas pipelines in common with water heaters and battleships that concerns magnesium?

Answer: Cathodic protection. Without the protection of magnesium anodes, a pin hole in the lining of a water tank or in the coating on a pipe line will cause leakage.

Question 7: What is the most startling effect of magnesium known on the behavior of another metal?

Answer: The addition of less than 0.1 per cent magnesium to cast iron converts it from a brittle low strength material to a ductile iron with strength up to 100,000 p.s.i. and considerable ductility.

Question 8: What are the effects of magnesium on aluminum?

Answer: Small additions in combination with silicon have a considerable hardening effect, owing to the formation of a compound Mg_2Si. Larger additions, from 1 to 10 per cent produce a range of strong corrosion resistant and weldable alloys used in rail cars and ships' structures.

Question 9: What elements will refine the grain of magnesium alloys?

Answer: Small amounts of carbon will refine alloys that contain aluminum and manganese. Zirconium has a remarkable grain refining action on alloys that do not contain aluminum.

Question 10: What grades of pure magnesium can be obtained?

Answer: Magnesium from sea water, produced in the U.S. and Norway grades 99.8 per cent. From Italian dolomite it is 99.90 per cent. From Canadian dolomite it is 99.95 per cent minimum with some production as pure as 99.99 per cent which is used in connection with beryllium manufacture.

Question 11: Can magnesium be anodized?

Answer: Yes, anodizing produces a ceramic type coating resistant to corrosion, abrasion and heat. When sealed with epoxy resin is one of the most resistant finishes known.

Question 12: What is the most popular structural use for magnesium alloys?

Answer: In die casting. On this continent chain saws use thousands of tons of magnesium alloy die castings. In Europe the Volkswagen plant expects to use 20,000 tons magnesium die castings in its engines in 1961.

Question 13: How is magnesium welded?

Answer: Using tungsten, inert gas (TIG) for hand welding and metal, inert gas (MIG) for automatic welding. Stress-relief is necessary after welding.

Question 14: What structural light metals, other than magnesium, are produced in Canada from Canadian ores?

Answer: None. Magnesium is the only light metal produced in Canada from all Canadian ores.

Question 15: What is the most recent discovery of the effect of magnesium on another metal?

Answer: The addition of 0.04 per cent magnesium to a zinc galvanizing bath improves drainage, and gives a silvery white coating that is not subject to "white rust" and has a life expectancy in years in excess of ordinary galvanizing.

SILICOLOGY

Studies in Silicones

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Some of the most astonishing things that hydraulic systems are doing today are being done by and because of silicone fluids. In automotive applications, for one, they're the lifeblood of certain long-lasting hydraulic transmissions, power steering, speed-and-temperature-regulated fans. In aviation and other fields, you'll find them in sensitive gyroscopes, damping devices, liquid springs, valve lifters.

MANY USEFUL PROPERTIES

Of course, designing such systems requires knowledge of silicone fluid behavior. Knowledge of viscosity-temperature properties, oxidative and thermal stability, lubricity, thermal expansion, effect on rubber seals of all kinds, compressibility, and apparent viscosity vs. shear rate.

This last is particularly important. And the well-defined shear-viscosity curve of UNION CARBIDE Silicone Fluids, combined with their unique temperature stability (remember that shearing raises fluid temperature), makes them among the most dependable of hydraulic fluids.

You may have heard or discovered for yourself that silicone fluids make elastomeric seals shrink, and may even have dismissed them from your consideration, much as you would like to take advantage of their other properties. Then here is news:

EFFECT ON RUBBER SEALS

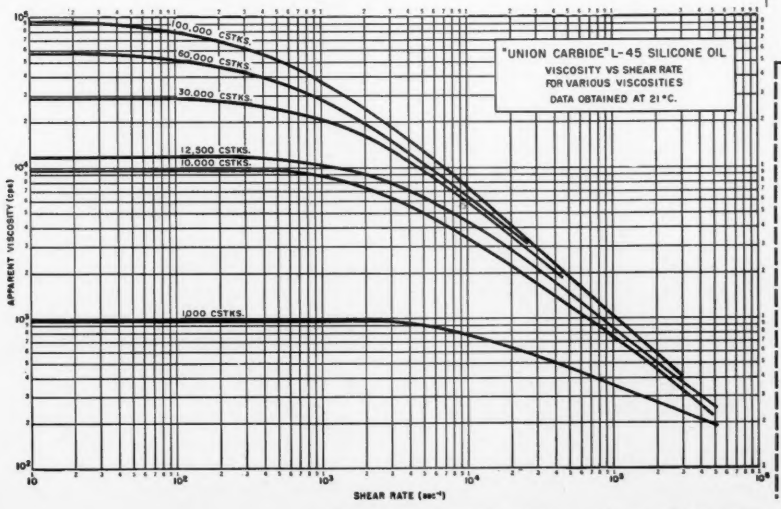
UNION CARBIDE has conducted extensive studies of the effect of silicones on various elastomers, and has shown how this problem can be easily met by the use of proper additives in the fluids. In the accompanying table you can see, for example, how "Plexol" 201 additive (Rohm & Haas) in silicones affects the per cent volume change of Neoprene W rubber. Similar data covers per cent weight change, compression set, hardness, etc. Moreover, these data are available on many other natural and synthetic rubber compounds.

How can you get them? They're available now, along with much other important information including more detailed shear-viscosity curves. Just mail the coupon for our latest "Design File" on UNION CARBIDE Silicone Fluids for Mechanical Applications. It provides in one handy package just about everything you need to know about silicone fluids for your projects.

Effect of Silicone Oil on Neoprene W Rubber

Immersion Fluid	% Volume Change	
	7 days 70°C.	4 days 100°C.
10° L-45	−0.51	−0.15
100° L-45	−0.47	−0.55
1000° L-45	−0.58	−0.69
1000° L-45 + 2.5% "Plexol" 201	4.47	3.75
1000° L-45 + 7.5% "Plexol" 201	17.02	18.60
L-527	8.34	10.66
Water	9.73	15.75

°centistokes



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People . . .
. . . and events

Fluid power standards a step nearer

Definite steps have now been taken toward drafting fluid power standards suitable to both Canada and the U. S.

Last month the newly appointed ASA committee on Standards for Fluid Power Systems and Components met in New York. Invited as observer was Charles F. Smith, chairman of CSA's committee B147 which is already considering fluid power standards.

Mr. Smith said it was intended that both the CSA and ASA committee would co-operate in developing standards suitable to both. There would also be liaison with the European ISO which already has a set of fluid power standards.

ALIKES"

Gaskets often look similar. But the important point is—what are they designed to do?

Today's complex problems of sealing call for a thorough knowledge of gasket materials and although this is important, factors such as joint design, temperature, effect of contained fluid and environmental conditions must also be considered.

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New company replaces Bepco Canada Ltd.

The British electrical engineering group, Metal Industries Ltd., has set up a new Canadian associate.

It is Dominion M.I. Ltd. which will have head offices and a plant in Montreal, with a branch office and repair department in Toronto.

Chandler

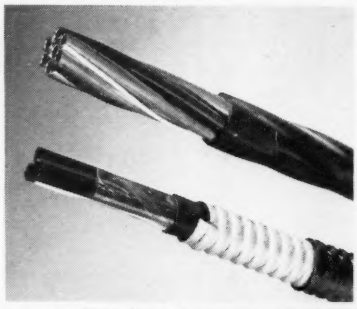
A spokesman for the parent company said the move followed dissolution of Bepco Canada Ltd., a consortium of British electrical manufacturers which included a Metal Industries Ltd. subsidiary.

Dominion M.I. Ltd. will manufacture specialized electrical control systems and equipment as well as act as a representative for its U. K. parent.

President and General Manager is E. A. Chandler.

Instrument harness now made in Canada

A wide range of single-tube and multiple-bundle instrument harness for process control applications is now being made



for the first time in Canada by Shaw Flexible Tubes Ltd., Rexdale, Ontario.

The company is licensed by Samuel Moore & Co. and Bailey Meter Co.

The instrument harness, already used in Canadian refineries, chemical plants, paper mills and other process plants was previously imported from the U. S.

Shaw will also manufacture three types of well-known industrial hose for hydraulic and pneumatic applications.

New electrical firms open at record rate

New companies manufacturing a broad range of electrical and electronic products were established during the first half of this year at a rate indicating a 12-year record for 1961.

A survey by the Bureau of Statistics shows that 19 new companies of this type opened up between January and June compared with 30 for the full twelve months of 1960. Record since 1950 is 37. That was in 1954.

A total of 292 similar new companies set up shop in Canada between January 1950 and June 1961.

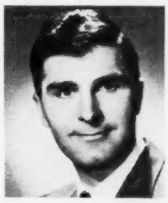
Men on the move

T. H. Beard, P.Eng., appointed chief engineer TEM Sales Company Ltd., Toronto.

Charles F. Smith, P.Eng., elected director Vickers-Sperry of Canada Ltd., Toronto.

Anders Lindstol, P.Eng., joins Graver Water Conditioning Co. and its affiliate

Smith



Beard

Smith & Loveless Company, Toronto, as chief engineer.

Charles A. Ulsh, P.Eng., appointed vice-president, manufacturing, Canadair Ltd., Montreal. Donald Dixon has been appointed director of aircraft manufacturing for the same company.

A. W. Mowat joins Eriez of Canada Ltd., Toronto, as chief engineer.

W. A. Fulton, P.Eng., Ontario's Deputy Highways Minister, has been awarded honorary life member of the Canadian Good Roads Association.

Peter T. McDevitt, P.Eng., appointed sales manager (plastics), Union Carbide Canada Ltd., Toronto.

James E. Smith, P.Eng., vice-president Computing Devices of Canada Ltd. appointed to Electronic Industries Association Ad Hoc Committee on Research and Development.

For your calendar

October 31-November 2: Pacakaging Association of Canada, National Packaging Exposition, Automotive Building, Exhibition Park, Toronto.

November 6-8: American Nuclear Society, Atomic Industrial Forum Conferences, Conrad Hilton Hotel, Chicago.

November 6-8: Chemical Institute of Canada, Chemical Engineering Division, Royal York Hotel, Toronto.

November 13-16: International Conference on Magnetism and Materials, Westward Hotel, Phoenix, Ariz.

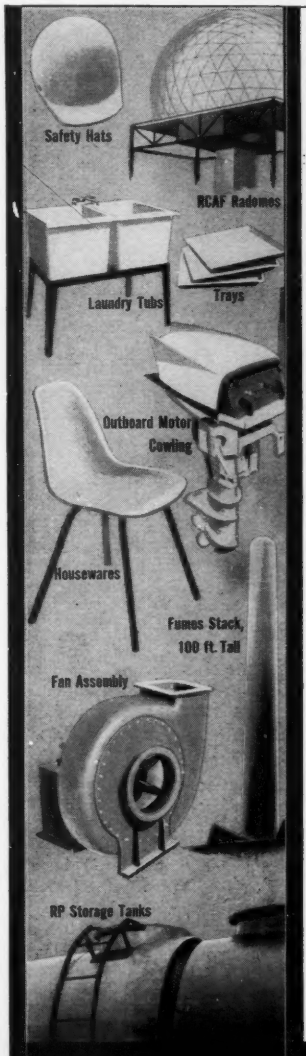
November 13-18: 2nd Engineering Materials and Design Exihibtion and Conference, Earls Court, London, Eng.

November 14: First Canadian Office Planning and Design Conference, Royal Bank of Canada Building, Place Ville-Marie (still-incompleted), Montreal.

November 26-December 1: American Society of Mechanical Engineers, winter annual meeting, Statler Hilton Hotel, New York.

December 2-5: Annual International Visual Communications Congress, Biltmore Hotel, Los Angeles.

December 7-9: Canada's Power Show, Queen Elizabeth Building, Exhibition Park, Toronto.



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14. Colorful—any colors or shades can be processed right into the material
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16. Excellent non-magnetic properties
17. Excellent acoustic properties
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19. Runs as low as 500 moldings practicable
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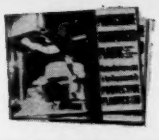

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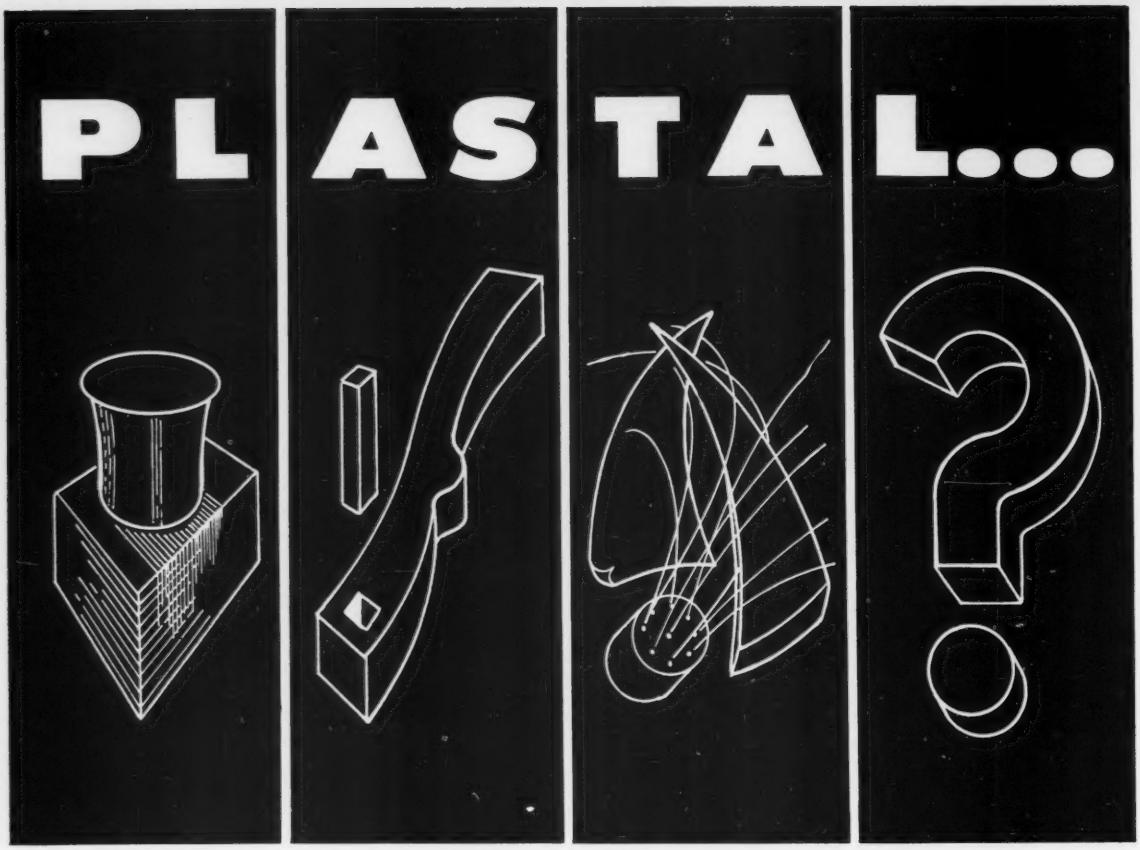

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Letter to the Editor

Magnesium will cause sparks

Dear Sir

Re your article: "Our Designers Rediscover Magnesium" in June 1961 issue.

A major point made in this article is that magnesium is non-sparking and hence is safe for use in explosive atmospheres, such as in dusty grain-bins, in the presence of fuel fumes, etc. I would like to call your attention to the work done in Britain(1) which shows that magnesium, magnesium/aluminum alloy, and (if I remember correctly) even pure aluminum will cause dangerous sparks if these materials strike or rub against surfaces of rusty steel or rusty iron. I would also call your attention to N.R.C. Report No. 4968(2) which shows that magnesium alloy/rusty iron sparks will also ignite grain dust clouds.

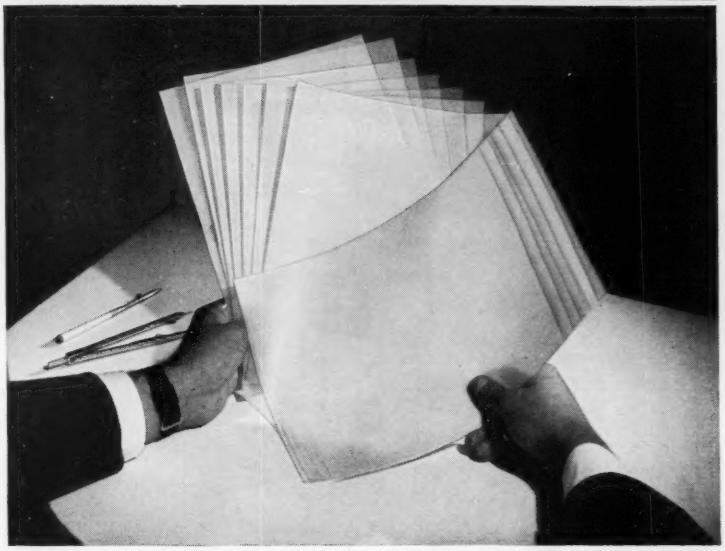
Therefore, I feel that the applications particularly mentioned in this article are, contrary to the statements made, possible hazardous applications. The hazard is relatively obvious in the case of grain buckets, for example, for one can visualize a fairly powerful glancing blow occurring. The hazard with respect to propellers and wheels may not be so obvious, and in fact may not be worthy of concern, but it involves the crash-land of an aircraft; tests in the U.S.A.(3) indicate that mechanical sparks may be the cause of ignition of spilled aircraft fuel at such times.

A. R. Morse,
Electrical Engineering Section,
National Research Council,
Canada.

References

1. Great Britain Safety in Mines Research Establishment, Research Reports Nos. 42, 59, 75, 90, 95, 113, 114 (see especially Nos. 75 and 90, e.g. No. 75 p. 14: "Experiment has demonstrated that the impact of a 36-lb. weight of magnesium alloy dropped from a mere 1.5 feet onto steel work can produce incendive sparking" (of firedamp)).
2. "Investigation of the Ignition of Grain Dust Clouds by Mechanical Sparks" by A. R. Morse—NRC Report No. 4968, Nov. 1958. Ignition of a grain-dust cloud of 3% concentration was achieved by a mechanical spark from a glancing blow using as the striker a magnesium/aluminum alloy A280.
3. "NACA Research on Aircraft Crash-Fires" by I. I. Pinkel—First Fire Research Correlation Conference, Washington, D.C., 8th/9th Nov. 1956. "From the standpoint of crash-fire safety, the use of steel, magnesium, and titanium should be avoided on parts of the airplane likely to bear on the ground in a crash." (p. 182)

DRAFTING TRENDS



Appearance is not a good indicator of drafting film workability or reproduction quality—see test offer below.

In drafting films, it's the coating that counts

Film Similarities

All drafting films share one common characteristic—*every* major brand employs a polyester base. This polyester material may vary somewhat in grade (from clear to milky) or in gauge (from .002 to .007). However, its properties remain so nearly identical that no appreciable difference in print-back speed can be noted by exposing diazo material through the uncoated film. Accordingly, all polyester films have these unique features: dimensional stability, transparency, flexibility, moisture-resistance and tear strength.

Coating Differences

These advantages mean nothing to the engineer, draftsman or architect until a surface receptive to pencil and ink is put on the film. POST applies three distinct micro-coatings to its polyester film, baking these elements and the film at such high temperatures that they are literally fused. This process also "pre-shrinks" the material, endowing Polytex with slightly greater dimensional stability.

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To convince you, regardless of previous or present drafting film experience, that POST Polytex offers a superior coating with outstanding erasibility, pencil and ink adhesion, a free Polytex test kit is yours without obligation. We'll mail an 8½ x 11 drafting film sample, plus a vinyl eraser and drafting pencil assortment. Write for it on your letterhead today.

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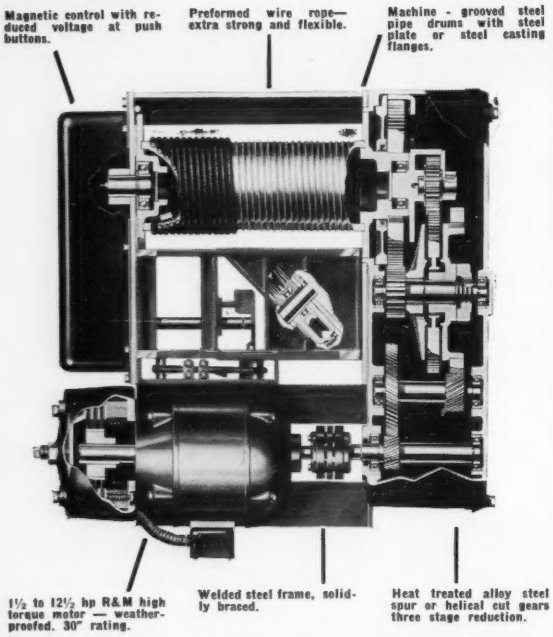
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Robbins & Myers are now manufacturing the famous 'work-horse' Type F3 Hoist in Canada. Type F3 Hoists have beam-hugging profile for more usable inches in lift without special design or higher runways, permitting closer end approaches and generous side clearance. Available in ratings from 1½ to 7½ tons capacity, F3 Hoists offer special safety features to prevent damage to hoist or injury to operator: weight-type upper limit switch; low-voltage control circuit; full magnetic controls; Weston-type multiple disc automatic load brake; and others.

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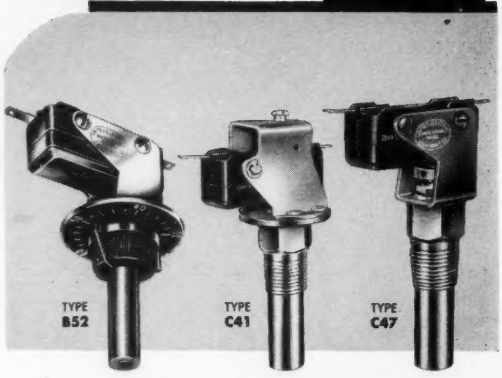

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Switch Actions	N.O., N.C., or Double Throw, no neutral position
Electrical Connection	attached directly to screw or solder terminals on switch
Size & Weight	approx. weight . . . 4½ oz., approx. size . . . 3⅞" x 2" x 1¼"
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Briefs

by Tony Stevenson

Cable sealing: A new process for effective waterproof sealing of electrical cable to a fitting has been developed by Dominion Electrohome Industries Ltd., Kitchener. Ont. It involves an electronic 1¼ kw plastic welder, coupled with a specially designed changeover switch.

Improved CL-44: Minor modifications to the structure of the Canadair 44 have boosted the aircraft's range by 11% and payload with full fuel by more than 15%. The aircraft's maximum take-off weight got a lift to 210,000 lb.

Rabbit's night life: Scientists trying to keep an eye on the habits of rabbits strapped a tiny radio transmitter to some unsuspecting bunnies. They found that they awake about 5 pm, eat and start out on their night rounds to return to bed about 7 am.

Printed circuits: Applications for printed circuit boards continue to grow, but sharp competition has forced the industry's profits down. The Institute of Printed Circuits says U. S. sales of $25 million last year were up 36%, while average profits after taxes slumped 3.2%.

Nitrogen shrinking: Eight steel trunnion pins, each over 2 ft across, were nitrogen shrunk to fit four 100 ton ladles in an English factory. A total of 1,232 gallons of liquid nitrogen in an insulated 2 ft deep tank reduced the pins' diameter by approximately .04 inches.

Locos for Ceylon: Another two Canadian-made diesel-electric locomotives have been shipped to Ceylon by General Motors Diesel Ltd., London, Ont. They were donated by the Canadian government under the Colombo Plan. Ceylon already has ten similar units which are named after Canada's provinces.

Stapler upgraded: A U. S. manufacturer of office stapling equipment has turned its hand to design of medical equipment. It modified an ordinary stock model for stapling a sterile cap to the skin edges after surgical incision.

Ion engines: The tiny ion engines, still in the experimental stage, have posed problems in testing and measurement of their thrust. One answer is a weighty but sensitive 2½ ton machine which can record a thrust as gentle as one-thousandth of a pound — the equivalent force of normal breathing.

Chalkboard market: An export market for Canadian cerametal chalkboard is being developed by Cerametal Industries Ltd., Streetsville, Ont. The first order has come from the West Indies where the material will replace old-style blackboard slate in modern schools.

Plastics study: A comparative study of the investment and production requirements of major plastics processes is being undertaken by a U. S. research organization. Believed to be the first ever undertaken, the study will cover blow molding, injection molding and reinforced polyesters.

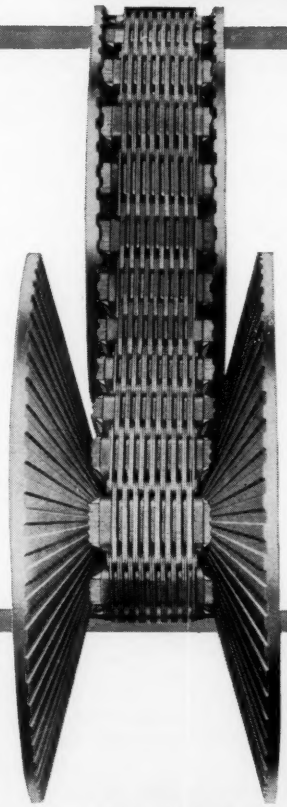
New names: American Society for Testing Materials now becomes American Society for Testing and Materials to emphasize research work in seeking knowledge of the nature of materials. Another new name is the Incinerator

(Continued on page 84)

UNIQUE IN ITS FIELD

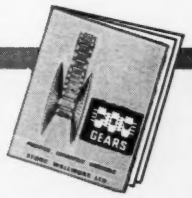
THE P.I.V. GEAR

POSITIVE INFINITELY VARIABLE



For a variable speed gear which is *positive* there is no alternative to the P.I.V. It is absolutely positive as the patent chain and wheel faces ensure "No Slip". An infinite variation of speeds up to a range of 6 to 1 can be obtained. The speed can be adjusted under load and will remain constant.

The high efficiency is maintained as the correct engagement of the chain with the discs is independent of stretch and other related factors. The gear has a very long life as no part is subject to wear except the chain; the life of which depends on the load, but can be reckoned in years.



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Briefs — *continued*

Committee of ASME, set up to deal with the problems of air pollution and refuse disposal through burning.

Talepiece: The Canadian Manufacturers' Association journal "Industry" reports this example for convincing employees of their usefulness to an organization. Headed "You Arx Important," it continues:

"Whxn you arx txmptxd to takx a day off without notifying your managxr, and you think that thx absxncx of onx pxrson won't makx too much diffxrxncx, you placx your managxr in thx samx position as a fxllow trying to typx with onx kxy missing. Hx can makx substitutions just as wx havx donx, but thx rxsult is nxvxr thx samx as whxn hx's working with thx right pxoplx on thx right jobs."

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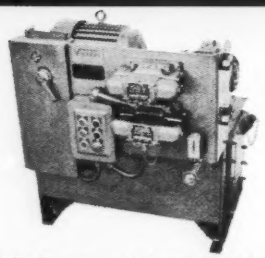
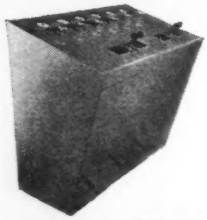


Hydraulic pump, controls and all related electrical equipment can be furnished as a single unit for simple application.



Control consoles such as this one used to provide smooth control for paper mill are regularly furnished by Vickers-Sperry.

Your package size can vary from a relatively simple and compact unit to one requiring a number of power units and valve panels plus control consoles. Whatever the specific need, Vickers-Sperry systems are assembled from the finest quality components by expert technicians—then are subjected to rigid inspection and testing prior to shipment.

When you buy a packaged hydraulic system, you gain the added advantage of dealing with a single, responsible source. Also, when this source is Vickers-Sperry, you can get assistance from fully-qualified electro-hydraulic application engineers in every phase of the job—beginning with initial design and continuing right through final start-up.

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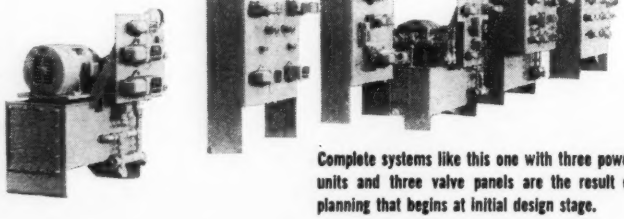

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Technical literature

Metal Seals—Catalogue describing all-metal seals for use from —450F to +1500F and under impulse pressures to 40,000 psi. E. B. Wiggins Oil Tool Co.

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V-Band couplings—Booklet outlining economies in cost and weight for various joining methods. Aeroquip Canada Ltd.

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Selenium photovoltaic cells—Bulletin discussing the features, selection and application of a newly developed cell. Daystrom Ltd.

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Wet blasting — Bulletin outlining how precision finishing operations reduce costs. Wheelabrator Corp. of Canada.

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Instrument catalogue—Revision of a condensed catalogue describing instruments and systems for scientific measurement, recording and testing. Honeywell Controls Ltd.

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Bearing fasteners—Comprehensive catalogue on a full line of tolerance rings for fastening and torque transfer. Roller Bearing Co. of America.

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Slip rings—New catalogue specifying the latest types of slip rings, brush assemblies, rotary switches and commutators. Slip Ring Co. of America.

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Aluminum coating gauge — Brochure discussing an instrument for non-destructive measurement of non-conductive and non-ferrous coatings. Twin City Testing Corp.

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Nickel plating—Literature on a new semi-bright nickel plating process that produces a sulphur free deposit. Canadian Hanson & Van Winkle Co.

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Condenser tubing—Booklet detailing the use of stainless steel tubing in condensers. Allegheny Ludlum Steel

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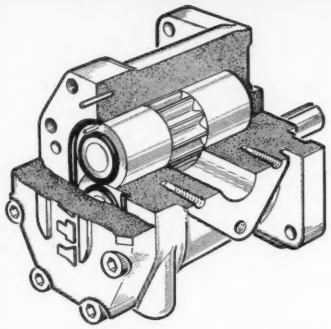

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Technical literature *(Continued)*

sealed connectors designed for high temperature and high pressure applications in nuclear missile fields. Physical Sciences Corp.

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Precision bearings—A new catalogue with a complete compilation of engineering information on miniature precision bearings. Miniature Precision Bearings, Inc.

Circle 343 on Reader Service Card

Pneumatic meters—Bulletin specifying a series of pneumatic controllers, transmittors and receivers. Canadian Meter Co. Ltd.

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Metal fasteners—Brochure explaining product value analysis technique. H. M. Harper Co.

Circle 345 on Reader Service Card

Silicone rubber—Designers reference book with charts and photographs. Mechanical Rubber Products Co.

Circle 346 on Reader Service Card

Infrared cooling—Catalogue describing infrared cell cooling systems for direct and remote cooling of detector cells. Union Carbide Canada Ltd.

Circle 347 on Reader Service Card

Chemicals — booklet and detailed information on chemicals not otherwise provided for in present statistics, and demand for those now imported. Department of Trade and Commerce.

Circle 348 on Reader Service Card

Conveyers—Catalogue giving design and application data on a complete line of portable and adjustable conveyers, hinged-steel belt conveyers, and custom conveyers. May-Fran Manufacturing Co.

Circle 349 on Reader Service Card

Chain drives—Bulletin with simplified selection procedures to determine chain sizes, sprocket sizes, centre distances, chain lengths. Rex Chain Belt Canada Ltd.

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(Continued on page 86)

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Technical literature—*(Continued)*

designs are also discussed. Kearfott Div., General Precision Inc.

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Beryllium bolts—A review of the development of the first beryllium structural bolts. Standard Pressed Steel.

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Electron probe micro analyzer—Folder with data and specifications for use of the instrument in direct chemical analysis of samples less than one micron in area and one micron in depth. Philips Electronics Industries Ltd.

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Oil filters—Bulletin describing a new series of filters for use in mobile, industrial, marine and ordinance hydraulic systems. Vickers-Sperry of Canada Ltd.

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Brass—Booklet with data on composition, specifications, properties and other technical information about brass wire, rod and strip. H. A. Porter Co. Inc.

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Silicone rubber—Brochure outlining design and production properties of a silicone rubber that cures at room temperature for encapsulating, sealing and flexible mold making. Dow Corning Silicones Ltd.

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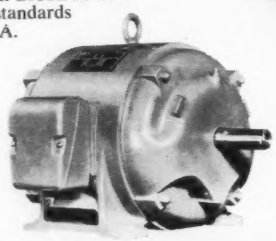

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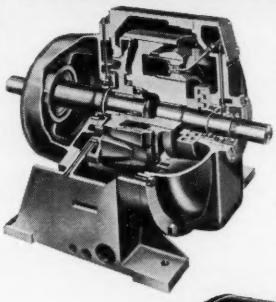

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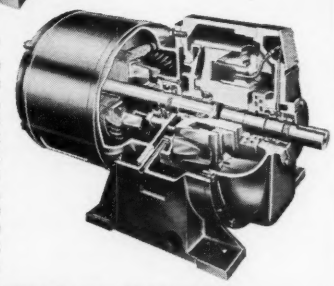

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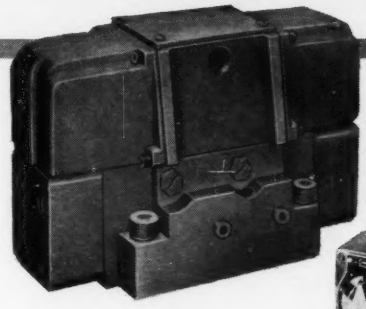

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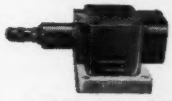

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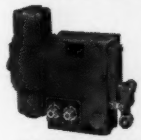

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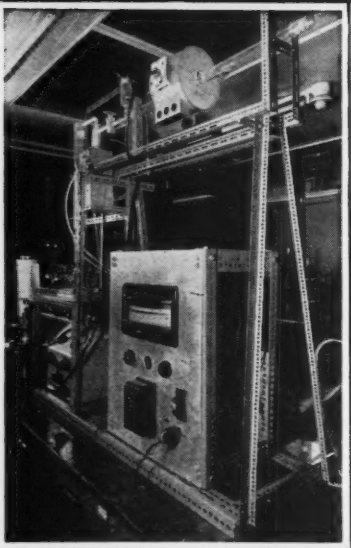

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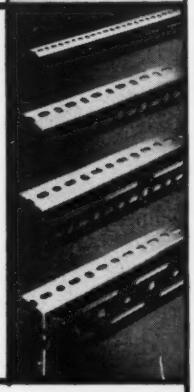

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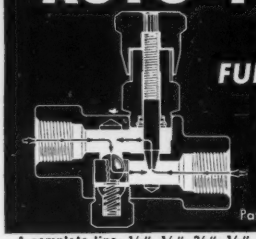

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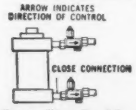

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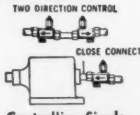

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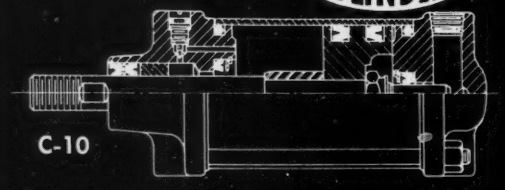

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Management education — Booklet prepared by the Small Business Branch following a nation-wide survey on the short courses, seminars and conferences available on a part time basis to executives and supervisors. Department of Trade and Commerce.

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Steel shelving—Catalogue outlining assembly features, component parts and advantages of three basic types of shelving. Standco Canada Ltd.

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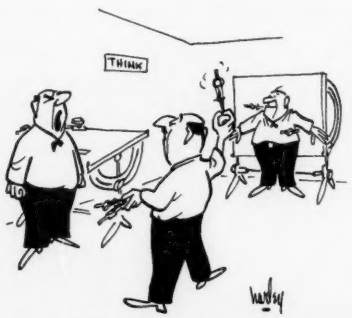

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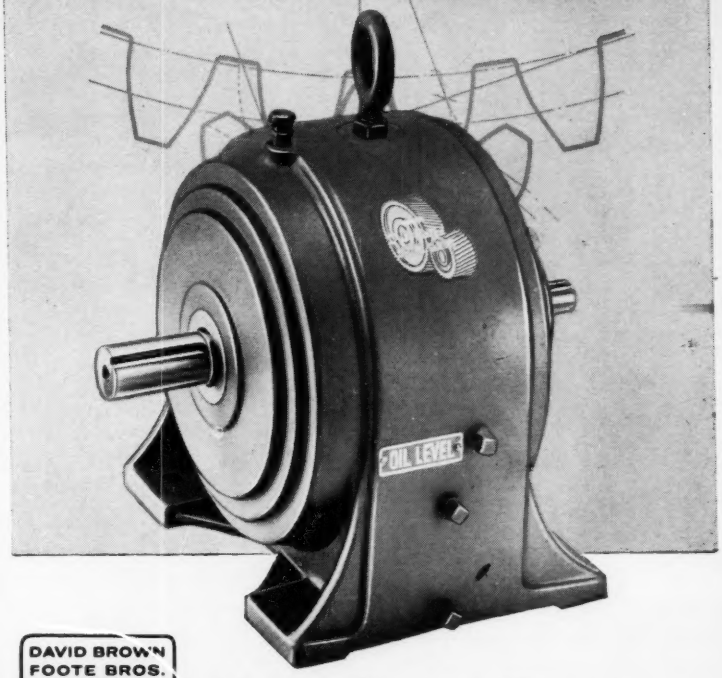

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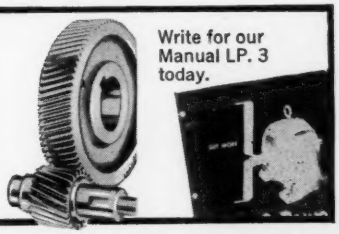

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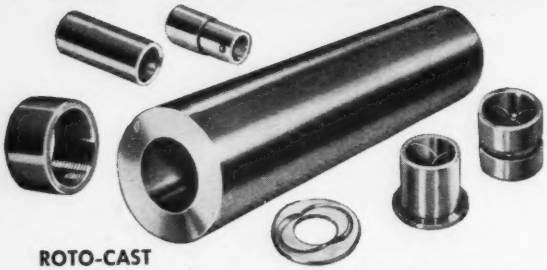

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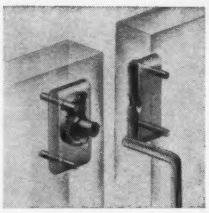

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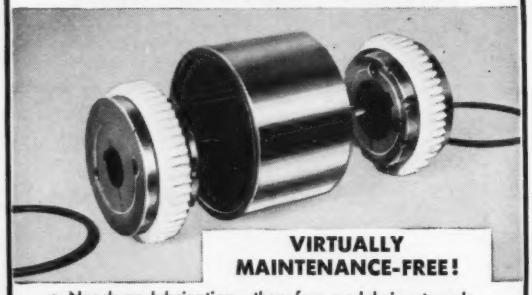

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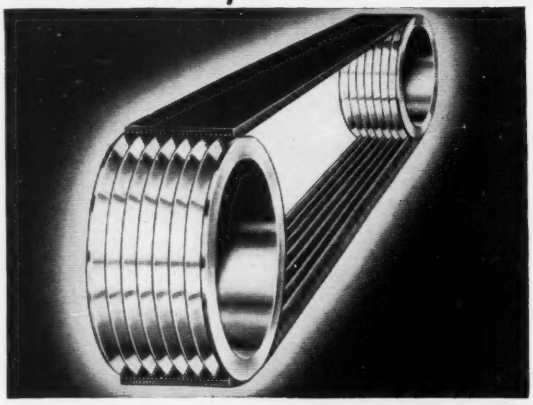

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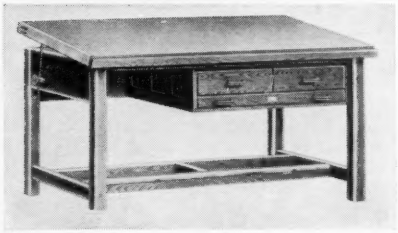

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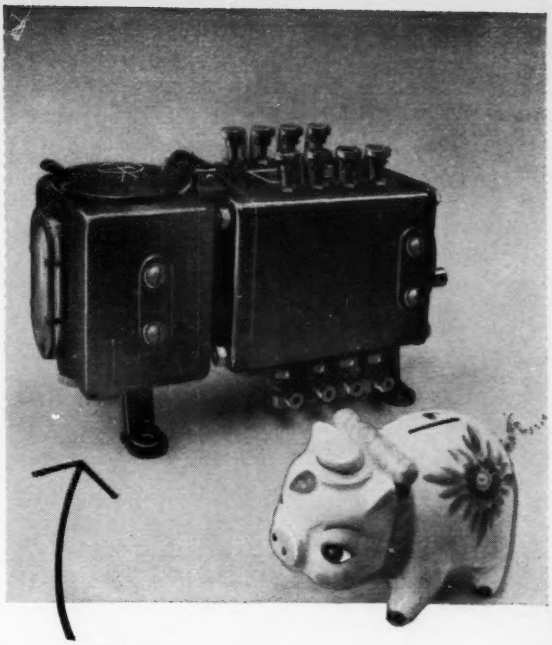

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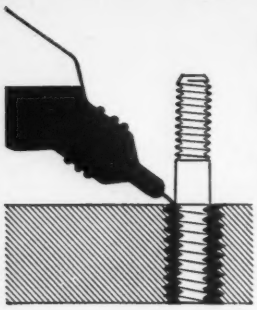

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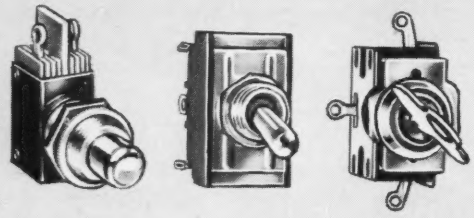

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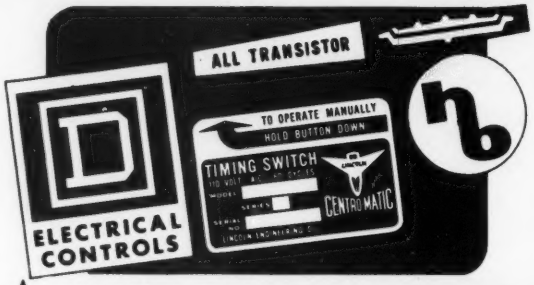

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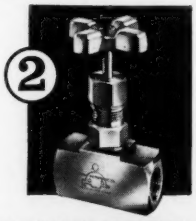

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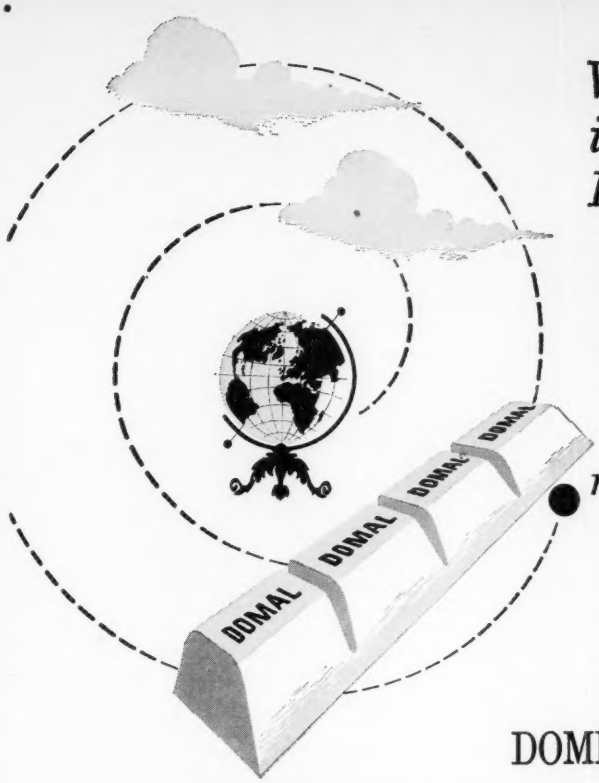

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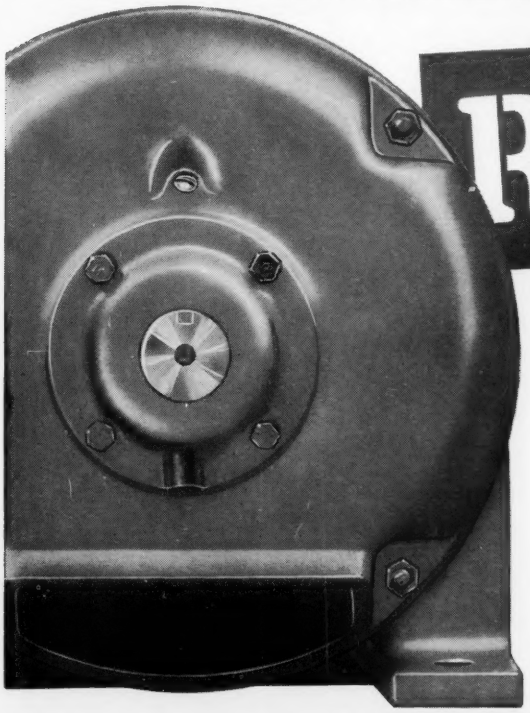

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backlash

New Quebec group

A story in the latest issue of the "Bulletin," official publication of the Corporation of Professional Engineers in Quebec, is worth repeating.

It tells of the formation of a "Groupe des Ingénieurs Professionnels de l'Hydro-Québec." Contrary to the wrangling that has developed between a similar group from the Ontario Hydro and the APEO, the Quebec group *"was instituted in the light of Council's views for the need of good engineer-management communications. The recommendations . . . approved by Council were used to establish the group on a sound and professional basis."*

The four objects of the new group as outlined in their constitution are:

- To look after the professional status of its members.
- To improve the quality of the services rendered to Hydro-Quebec by its professional engineers.
- To maintain two-way channels of communications between management and professional engineer.
- To establish two-way channels of communications between its members and the CPEQ.

The Bulletin further states that " . . . to provide guidance for employee-engineers desirous of improving communications with their employers, Council has defined group representation as a voluntary form of engineer-management communications within a given organization through some of the engineers in the organization representing the engineering personnel . . . they are *non-bargaining* associations employed by a given firm . . . their activities are carried out in accordance with professional ethics."

Perhaps the warring factions in Ontario might like to take a lesson or two from their Quebec associates. The fiery Frenchmen certainly seem to have found a satisfactory solution to the 'employee group' problem.

Engineers denied honor

The following appeared in 'the Engineer', a publication of the Engineers Joint Council, the US organization corresponding to the Canadian Council of Engineers. We thought you might enjoy reading what E. C. Easton, Dean of the College of Engineering at Rutgers University has to say about the place of engineers in today's race to the moon.

Recently the names of Gagarin, Shepard, Grissom and Titov were featured prominently in the American press. All four had been passengers in vehicles designed, built, and operated by others. Despite their relatively passive roles in their respective adventures these men were hailed and feted as though each had performed the miracle of space flight single-handedly. There was an editorial in the New York Times after Shepard's flight in which Shepard and even the astronauts who were trained, but did not make the flight, were given credit. Such reporting reveals an alarming ignorance of the area of responsibility for technological advances.

Let us have at least a faint cheer for the engineers who designed, built, launched and controlled the vehicle in which these space passengers rode. Let's be sure that the public knows that the real heroes were engineers, not scientists or astronauts. The scientific principles which govern space flight are few and simple. The engineering applications of those principles to accomplish a successful flight are incredibly complex.

An engineer told Shepard exactly what to expect at every instant of that flight. He told Shepard that he would experience so many G's within ten seconds and so many G's within 15 seconds; that, at such a time, the periscope would come down; that, at a given time, the rotating rocket would fire and that, at another specified time, the retrograde rocket would fire.

The exciting thing is that someone on the ground, an engineer, was able to predict this before the rocket was fired. Furthermore, Shepard had in front of him a little globe on which the position of that capsule was located at every instant, and on which there was an arrow pointing to a landing place, if Shepard were to push the retrograde rocket button. How is it possible to design a thing that will tell a man in a tumbling space vehicle exactly where he is at any instant of time? This ability to design a complex vehicle and to predict its performance before it leaves the ground is the most exciting feature of space flight. It is the most sophisticated talent ever possessed by the human race and it is the mark of the engineer.

—E. C. Easton

What they think

More than a quarter of American engineers are not happy with their lot in industry. This is the discovery of a recent survey of attitudes which sought to determine the biggest grumbles of today's engineers.

The questionnaires turned up a strong hint that engineers were mainly unhappy about the inadequate recognition for contributions to the company. Eighty percent of them felt that changing jobs brought better professional opportunities and higher salaries but there was still the "good old" natural reluctance to make changes.

The other interesting deduction was that less than 60% of engineers felt the flow of technical information was sufficient. Full details of the survey are available from "Industrial Relations News", 230 West 41st Street, New York 36. Cost is $3.50.

Watch Russian designs

A host of important Russian technical publications have been made available to North America subscribers for 1962. Published in Russian only they provide an opportunity to trace inventions and new advances being made by that country in a wide number of trade and professional fields.

On the engineering side the journals cover many subjects from hydraulics to radio and electronic engineering. Prices for Canadian subscribers range from $3 to $42 per year. Publishers include the U.S.S.R. Academy of Sciences and the Moscow University.

For further details
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announcement

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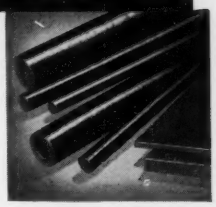

Chemloy 719 is proving to be the most *universal* dry bearing material ever offered to industry:

. . . because its extremely low coefficient of friction invites use where lubrication is impossible, impractical or undesirable.

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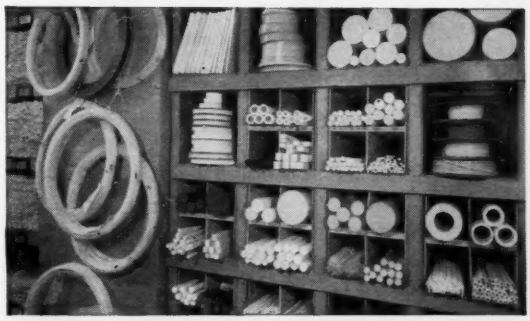

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Editorial

Let's get the cart before the horse

. . . good design is the secret of export sales

Reports of proceedings at the recent meetings of the Canadian Chamber of Commerce held in Halifax succeeded in scaring the pants off many Canadian businessmen . . . we wish that many more were similarly affected. In the face of rising foreign competition, future prospects for export of Canadian industrial products gave many of us the first serious jolt we've had for many a year. The facts are there for all to see and heed . . . unless we do something drastic about it, Canada's honeymoon with prosperity is fast drawing to a close.

World markets for our exports are getting to be more difficult to sell every day. If we cannot export, we are definitely in for a rough time. What's to be done about it? From where we sit we can see three distinct courses: we can sit back and do nothing (and it's surprising how many businessmen are doing just that!) . . . we can appeal to the Government to solve the problem for us (and it's even more surprising how many businessmen think this is a truly government responsibility) . . . or we can take personal action in the matter to determine what we can do about it ourselves. Is it true, as Canada's business leaders hinted at Halifax, that we are overly cautious — or plain lazy — in not being sufficiently aggressive in seeking overseas markets?

What has this to do with the design engineer? *Everything.*

Where does the designer fit into this picture? *Right in the centre.*

Well-designed products find ready markets and repeat business. Well-designed Canadian products are in use the world over. Large machines, like De Havilland's Otter, Beaver and Caribou or the Massey-Ferguson combine, are examples of world leadership by Canadian products. Smaller products, like the Kipp Kelly separator, Hasting's optical machines and J. A. Wilson's lighting fixtures — and there are hundreds others — are also good examples.

Bob Kipp makes a practice of designing world leaders . . . then he spends four months a year traveling and selling them in more than 60 countries, including several behind the Iron Curtain. George Rickwood, president of Hastings Machine Tool Company, travels thousands of miles a year selling their designs all over Europe. Neither find excessive sales resistance for their products . . . the secret of their saleability is in their good design.

Then there's the other type of operation. Many Canadian-designed products merely meet demand for domestic sales against foreign competition and go no further than that. Improved design . . . or maybe even just a little more sales promotion . . . would result in foreign sales and profit.

How much responsibility should the designer shoulder for the failure of his company to take advantage of possible foreign markets? In most cases, the designer has his eye focussed on the marketplace when he is developing the product. Should he modify the design slightly to meet the export market's needs? His ideas and opinions carry a lot of weight in management planning sessions — and if they don't, it's time that something was done about it. And when the product sells in the face of foreign competition, who takes the greatest pride in the accomplishment? You guessed it—the designer.

In designing products for tomorrow's world we must raise our sights above the domestic markets and take a good look at the needs of foreign countries. Only then will Canadians — you and I — have a chance to increase our share of the world markets.

Doug Kaill

Ask your Gates Representative to show how Super HC Drives save space, weight, money

If the sheaves and V-belts of a machine need replacing or if a chain, gear or other type of drive isn't giving you good performance, your local Gates Representative will be glad to help you. He can show you how to take full advantage of the many opportunities offered by Gates Super HC High Capacity Drives.

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Gates Super HC Drives give you these benefits:

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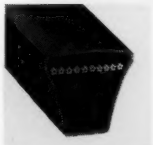
Belt speed up to 6000 ft/min possible without dynamic balancing.

Less costly, higher speed motors can often be used.



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World's largest maker of V-Belts

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